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April-June 2009

Number 1069
Volume 134

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Published by the Yorkshire Naturalists' Union

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SOME YORKSHIRE FUNGI

C. R. STEPHENSON

Presidential Address to the Yorkshire Naturalists' Union, Scarborough, 28 November 2008

Carl von Linné, better known by his Latinised name of Linnaeus, established the foundation of modern systematics in the mid-18th century. The previous simplistic view recognised two Kingdoms, animals and plants, based on the fact that animals moved and plants did not, which is undeniably true, but hardly a good scientific definition. This concept continued unchallenged for almost three centuries and was not reviewed and replaced until the latter part of the 20th century. Advances have shown that two Kingdoms are hopelessly inadequate to encompass the huge diversity of life on earth, and today, a multi-Kingdom structure of life is not in dispute.

Although fungi were originally allocated their own Kingdom, they are now to be found in two additional ones, the first being Protozoa into which the slime moulds, the Myxocota, have been placed. As long ago as 1864 de Bary had proposed that these were not true fungi, but actually protozoa, a conclusion which did not receive full support because of their fungus-like nature. Such a placement has been confirmed by modern studies. *Physarum confertum* T.Macbr. is an example of this group, a species found by the author's wife, growing on moss in Forge Valley in May 2002. It is a rare species which was new to Yorkshire at that time, previously known only from Sussex, Kent, Norfolk and Scotland.

The second Kingdom, Chromista, includes a section of fungi which were previously placed in the oomycetes, now a much more tightly circumscribed group. *Albugo candida* (Pers), O.Kuntze, the cause of white blister rust of shepherd's purse and other bittercresses, is one such example.

The main Kingdom for fungi still houses the familiar mushrooms and toadstools, the polypores, the cup fungi and all their relatives – but how do such fungi obtain their nutrients? This is achieved by three strategies. Some are parasites, living in or on and obtaining their nutrients from another living organism. Others are saprotrophs, living off

Sarcosphaera coronaria

the dead remains of another organism. This method of nutrition is the main reason why fungi are the principal agents of natural decay and nutrient recycling. The third way is by forming symbiotic associations with plants or animals. The mycelium from which the spore-bearing structure, or fruit-body, grows is thin and cobweb-like and in the case of ectomycorrhizas wraps itself around tree roots, whereby nutrients and moisture are exchanged. In effect, in this relationship the fungus extends the range of the tree roots.

There are eleven Phyla of fungi. A major one is the Ascomycota where the spores are developed within a sac called an ascus; there are considered to be 5,500 species recorded in Britain. Those ascomycetes with cup-shaped or discoid fruiting bodies are often referred to as the discomycetes, an example of which is *Sarcosphaera coronaria* Jacq., a Red Data List species, forming a large, cup-shaped, fruiting body, which develops below ground, bursting through the surface to reveal a purple interior when mature. It seems to prefer limestone and has been found at four sites within Dalby Forest; it was first found in 1966 when Gordon Simpson recorded 120 fruit-bodies, but the number of fruiting bodies varies from year to year.

In contrast, *Chlorociboria aeruginascens* Nyl. is a small bluish-green fungus that stains the wood it grows on dark green. *Hydnotrya cubispora* Bessey & Thompson differs from the above in that although being related to the elf cups, its cup is completely turned within itself and the fungus is subterranean. It was found in soil amongst spruce needles in Dalby Forest in November 1988, the only earlier records being from Scotland. It appears to be an American species and will undoubtedly have been introduced to its present sites. The prominent, truncate ornamentation at the poles of the spores are very characteristic of this species.

Those Ascomycota possessing flask-shaped fruiting structures are pyrenomycetes, which are usually black and appear burnt, hence the name which means fire fungus. *Xylaria polymorpha* Pers., "Dead Man's Fingers", is usually found in small clusters at about soil level on dead stumps or branches of sycamore and oak and here a multitude of the small, flask-shaped fruiting bodies are embedded in a large finger-like mass of sterile tissue termed a stroma. *Daldinia concentrica* Bolt. ex Fr., "Cramp balls" or "King Alfred's Cakes", in contrast, has flask-shaped structures that pepper the surface of a large hemispherical stroma. It is commonly found on reasonably thick, attached as well as fallen, branches of ash. The English name of cramp balls comes from the fact that they were thought to cure cramp if placed in the clothing next to the effected limb.

The very unusual *Chromocrea cupularis* Petch, unlike the other two examples of pyrenomycetes above, is cream coloured, which turns greenish, and the 16-celled spores are dark green; it was found in Dalby Forest in September 1992 growing on a decorticated pine log, sadly removed the following year. It is possibly rare, as there seem to be no recent British collections.

Some of the most conspicuous fungal plant parasites are found in the Taphrinales, which differ from the discomycetes in not forming an obvious fruit body, utilising the organs of the plants they attack to form an irregular structure. *Taphrina alni* Kuhn, for example, infects the scales of female alder catkins causing them to produce a tongue-shaped pink outgrowth. Once thought rare, it is apparently extending its range within Britain.

The second major phylum is the Basidiomycota, of which 3,600 species have been recorded so far from the British Isles. The first class is the basidiomycetes, the mushrooms and toadstools, in which, depending on the species, the spores are borne on three possible types of tissue (i.e. plate-like structures termed gills, veins or in tubes), the gilled fungi being the most frequently encountered.

In *Hygrocybe calyptriformis* Berk. the spores are produced on the sides of gills. As this species was proposed as a provisional Red Data List fungus, concentrated efforts have been made to record this fungus and we now know that over 50% of its sites known in Europe are to be found in the British Isles. The author knows of three sites in his own recording area around Scarborough. *Psuedocraterellus undulatus* Pers., however, has spores borne on

Hygrocybe calyptriformis

raised veins and is rarely recorded. It was first recorded by the author in Newton Dale in October 2000, growing under beech and is the only site known within his recording area.

In the spectactular *Boletus luridiformis* Rostk., although the spores are borne in tubes, the fruiting body is putrescent and easily decays, in contrast to the bracket fungi which are tough or leathery. These tubes have apertures which are orange-red when young, becoming yellowish-olive with maturity, and the stem has longitudinally distributed red punctae; the yellow flesh immediately turns deep Prussian blue on exposure to the air, as do the stem

Lycoperdon echinatum

Polyporus umbellatus

and cap on bruising. It is usually found on acid soils with birch.

For many years those fungi whose spores are typically produced and mature inside their fruit-bodies were called gasteromycetes, meaning stomach fungi, but this is now an obsolete term. This group includes the puffballs, earthstars, earthballs, birds nest fungi, stinkhorns and false truffles.

Lycoperdon echinatum Pers. is a rare puffball covered with hedgehog-like spines, which is usually found on chalky soils. The author first found it growing in leaf litter under a high hawthorn hedge by the road-side in Hackness Park in 1984. It continued to appear at this site until 2000, when the hedge was removed.

Guepinia helvelloides

The sessile earth star, *Geastrum fimbriatum* Fr., is frequently encountered and although the inner sac somewhat resembles a puffball, the outermost part splits to form fleshy rays as in a star, hence the common name. In fact, this fungus is neither related to the puffballs, nor to the birds nest fungi, of which *Crucibulum laeve* Huds. is an example. The latter species grows on fallen deciduous twigs and is initially covered by a skin, which breaks to reveal a group of spore-parcels (the eggs in the nest!) which are forced out of the cup by the energy of rain-drops falling into the fruiting body to release the spores within.

Stephanospora caroticolor (Berk.) Pat. is a rare false truffle; it is hypogeous, pushing itself just through the surface soil and, as the name suggests, is easy to spot because of its bright carrot colour. The author first found this uncommon fungus in September 1983 in Forge Valley.

Having divided off the agarics and the gasteromycetes, former taxonomists were left with a large and confusing assortment of different shaped basidiomycetes, which they placed in a catch-all order, Aphyllophorales, meaning non-gilled fungi. This order contained the brackets, club, coral and hedgehog fungi, but is no longer used.

Polyporus umbellatus (Pers.) Fr., a rare example of a bracket fungus, which sprouts from a black resting body termed a sclerotium, was found on an old beech stump in Raincliffe Woods in August 1975. Here it was monitored for the next 24 years, being successfully re-found, although some way away from the original site, by the author's wife in August 1999. The unusual shape makes this fungus easy to spot due to its unmistakable, umbrella-like caps formed at the ends of branched stalks.

The rather rare *Ramaria flava* (Schaeff.) Quel., one of the many coral fungi, was found on 25 August 1993 under beech in a wood near Whitby, just outside the author's recording area.

Auriscalpium vulgare S.F. Gray, the "Ear-pick Fungus", is only found on decaying conifer cones; it is so named because the spores are borne on a narrow stalked fruiting body with downward pointing spines. It is apparently rare in Yorkshire, but W.G. Bramley recorded it in March 1954, June 1958 and July 1964.

The jelly fungi are linked to the mushrooms and toadstools even though the basidium, the cell on which the spores are borne, is septate. Members of this group generally possess gelatinised tissues. *Guepinia helvelloides* Fr., a rare example of this group, possesses a basidium which under the microscope looks like a hot-cross bun when seen from above. It is a beautiful, gelatinous, pink, trumpet-shaped species first found by the author in October 1980 and later at six different sites in Dalby and Wykeham Forests, usually growing on buried wood along the sides of woodland rides. It is a Red Data List species and these two forests are the only sites in Yorkshire where it occurs.

Pseudohydnum gelatinosum (Scop.) P. Karst. is a small, bracket-like species of jelly fungus, whose spores are borne on downward-pointing pegs as in *Auriscalpium vulgare* mentioned above. It is usually found on old, decaying, large conifer stumps, as in Dalby and Wykeham Forests where it has been recorded on three occasions.

The teliomycetes, containing the rust fungi, possess many similar structures common to the jelly fungi. They are without exception plant parasites and often have complex life-cycles, commonly involving more than one host plant and up to four different spore stages. There are 700 known species in Britain. *Puccinia albescens* Plowr. is an uncommon, very pale yellow rust that occurs on *Adoxa moschatellina*. The author first found it in Yederick Woods in May 1982, where it was again recorded in 1983 and 1985. In contrast, *Trachyspora intrusa* Grev. is rich orange-red and showy, and is found on *Alchemilla* species, where it over-winters in the rhizomes, so can be found at the same site each year, generally making the plant rather sickly.

The smut fungi, placed in the ustomycetes, are also plant parasites and can cause important diseases of cereal crops. As the name suggests, they are black. *Farysia thuemenii* Nannf. was found replacing the ovaries of the greater pond sedge at Thorpe Hall, Bridlington in June 1988. It is apparently rare as there appears to be no other Yorkshire record since 1945 when it was recorded (under the synonym *F.olivacea*) at Askham Bog. In

contrast, *Urocystis ranunculi* Lib. is common, forming silvery blisters in the leaves and stems of creeping buttercup, which burst to expose black masses of spore balls.

The last group of fungi to be considered has been called Deuteromycota, Fungi Imperfecti or Mitosporic Fungi, so-named because they only possess an asexual stage, either because the sexual stage has been lost from the life-cycle, or no-one has been able to make the link between any known sexual stage. There are two groupings, coelomycetes and hyphomycetes, names which merely refer to the form of fruiting structure and have limited taxonomic value. In the coelomycetes, the asexual spores, conidia, are produced in a definite flask-shaped or cup-shaped structure, whereas such structures are lacking in the hyphomycetes. An example of the coelomycetes is *Melanconium stromaticum* Corda, which occurs on dead twigs of hornbeam, and an example of the hyphomycetes is *Sepedonium chrysospermum* Fr. which is particularly conspicuous as it attacks boletes and converts them to a bright yellow, powdery mass that collapses on touch. The hyphomycetes contain the most familiar moulds and are supremely successful in making their presence known, even in the home, by colonising stale bread and damp wallpaper.

With the continued rapid development of techniques such as molecular analysis, the classification of fungi in recent years has become remarkably well understood and this will lead to much needed stabilisation.

Acknowledgements

The author is most grateful to Prof. Roy Watling, Prof. Mark Seaward and Mr Brian Cockerill for their help in the preparation of this article.

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THE SPREAD OF SOWERBY'S FRESHWATER JELLYFISH, *CRASPEDACUSTA SOWERBII* LANKESTER 1880, IN OUTDOOR SITES IN BRITAIN

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Following the appearance of Sowerby's freshwater jellyfish *Craspedacusta sowerbii* at its most northerly British locality in Hatfield, Doncaster in 2002, the history of its discovery new to science, its taxonomy, world distribution and British feral occurrences were reviewed and discussed in Howes (2002, 2003, 2005a, 2005b).

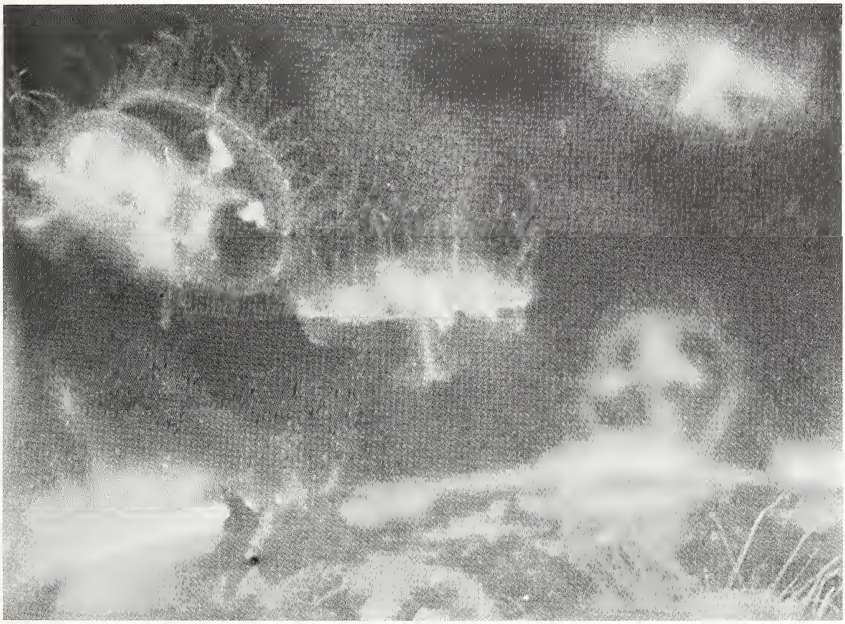

FIGURE 1. Medusae of *Craspedacusta sowerbii* from Hatfield Water Park, Doncaster, June 2002. (Photo: Terry Smithstone, Doncaster Museum.)

Thought to be a native of tropical Central and South America, though there is opinion that it was originally a denizen of China (Sowerby 1941), *C. sowerbii* is now naturalised in still or slow moving waters in many tropical and warm temperate regions of the world. More sporadically it has naturalised in higher latitudes in artificially heated conditions such as tropical lily tanks in botanic and zoological gardens. Since the 1950s, freshwater jellyfish, have occasionally appeared in heated freshwater aquaria, early British examples being in Oldham (Kidd 1956) and Manchester (Seyd 1967).

In Britain, feral populations have been encountered in unheated outdoor situations from 1928, but records have increased markedly, generally through observations by anglers, since the 1990s in such habitats as canals, shallow freshwater lakes, reservoirs and flooded sand and gravel quarries. Here their hydroid stages seem to attach to the submerged water plants, notably on Canadian pondweed (*Elodea canadensis*).

Following appeals for reports of British occurrences via the *British Wildlife Magazine* (Howes 2003), the National Federation for Biological Recording (Howes 2005b), the Environment Agency and the YNU Website, this study reviews the 26 records known to date from 22 sites extending from Exeter (SX99) in the southwest and Teddington (TQ16) in the southeast to St Helens (SJ49) in the northwest and Hatfield (SE61) in the northeast.

A chronological inventory, which lists the years, dates or seasons of occurrence, localities, grid references and information sources (Appendix 1), forms the basis of Figure 2 which plots the currently known distribution of feral populations. In order to monitor the temporal trends of its spread, Figure 3 aggregates records in five year periods from 1920; this indicates a rapid acceleration in encounters with jellyfish medusoid 'blooms' over the past two decades across Britain.

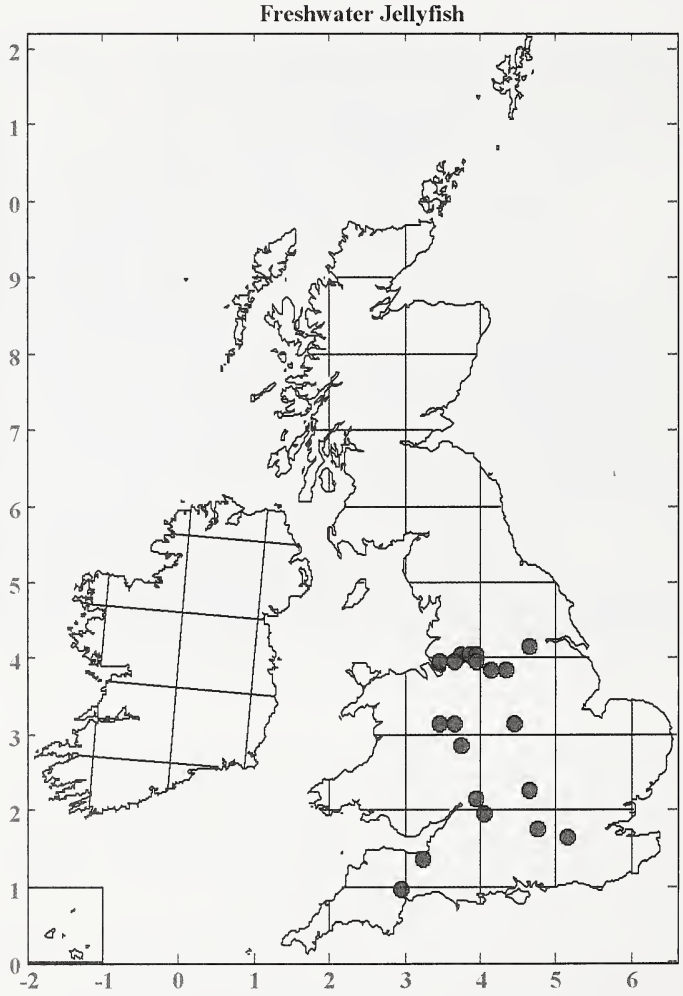

FIGURE 2. Recorded outdoor localities of *Craspedacusta sowerbii* in Britain.

Spadinger and Maier (1999) noticed a strong nocturnal feeding preference with medusae remaining in deep water during daylight hours and migrating towards the surface after dark, with the greatest number of copepod prey detected in jellyfish stomachs sampled at night. Since all British records to date have been noticed during daylight, it is likely therefore that nocturnal examination of still water bodies may reveal a greater frequency and wider distribution of occurrences than is indicated in this review.

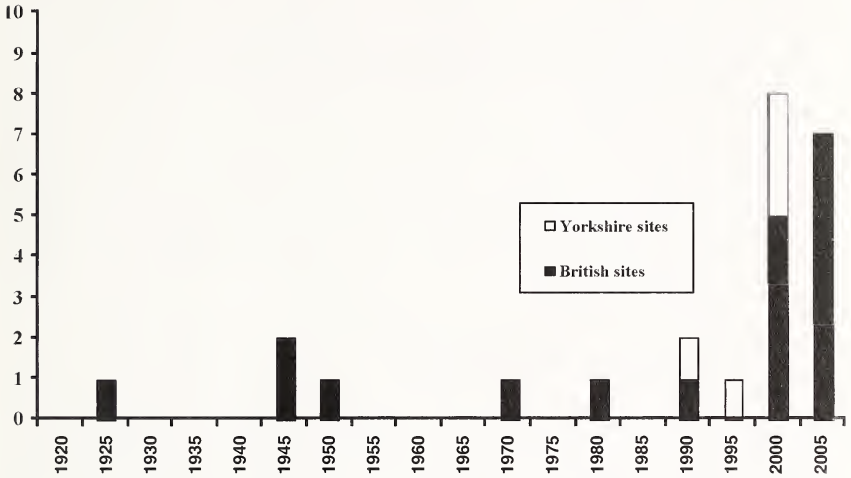

FIGURE 3. Increasing frequency of records of *Craspedacusta sowerbii* 'blooms'.

Spadinger and Maier (1999) also found that medusae ingested various zooplankton and benthic prey in the 0.1–3.0 mm size range. The selectivity indices for prey showed that larger zooplankton between 0.4 mm and 1.4 mm and vigorously active prey such as copepods were preferred. Small potential prey, the loricate rotifer *Keratella cochlearis* in particular, were almost never consumed. Measurements suggested that spacing between the tentacle branches could determine prey selection. Another possibility is that some prey are too small or slow to activate nematocysts after collision with the predator and that prey > 1.4 mm can probably escape or are otherwise too large to be overcome.

Feeding experiments with the captive samples of the Hatfield population by the author and Terry Smithstone showed that even dried aquarium fish food (consisting of the cladoceran *Daphnia* sp.) was somehow detected and actively captured. On sprinkling food onto the water surface, the quiescent medusae at the bottom of their container would swim up to the surface where their pulsating mobility enabled them to swing in a bell-like mode, causing their tentacle fringe to be flicked up to the surface film. The flailing tentacles of the medusae would forcibly brush against the inanimate food objects, evidently triggering the harpoon-like nematocysts. This enabled the tentacles to attach to the food that was then manoeuvred into the transparent tube-like stomach. Up to five *Daphnia* could be collected into the stomach of an individual medusa within the course of an afternoon. Spadinger and Maier (1999) found that digestion took from 4 to 5 hours. This behaviour suggests that this still-water jellyfish is capable of actively feeding on potential food objects trapped on the surface film.

ACKNOWLEDGEMENTS

I would like to thank R. Lawton and P. Scowcroft (Hatfield Water Park, Doncaster), Joe Boomer, Thomas Carrington, Alan George, M. Grey, P. Hardy, A. Johnson, J. A. King, S.

Lines, G. Meadows (Environment Agency, Thames West Area), Terry Smithstone (Doncaster Museum), M. Weldon, T. Whittle and G. Workman (Wigan Leisure and Culture Trust) and Mrs P. M. Wright.

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APPENDIX 1: Chronological inventory of encounters with feral populations of Sowerby's freshwater jellyfish *Craspedacusta sowerbii* in Britain

Year	Date	Locality	OS Grid Ref.	Source
1928		Exeter Ship Canal, Exeter, Devon	SX9291	Valentine 1930
1929		Exeter Ship Canal, Exeter, Devon	SX9291	Valentine 1930
1948		A colliery reservoir in Monmouthshire	?	Russell 1953
1948		Witcomb Reservoir, Glos.	SO9014	Russell 1953
1952		Rochdale Canal, Oldham	SD80	Kidd 1956
1970s		Exeter Ship Canal, Exeter, Devon	SX9291	Aves & Nichols 1977
1982	22 July	Bolton & Bury Canal, Little Lever, Manchester.	SD7406	Hancock 1983
1992	14-25 Aug.	South Yorkshire Navigation Basin, Sheffield	SK361877	Richards & Whiteley 1993
Late 1990s		Thames backwater, Teddington, Middlesex	TQ16	Green 1998

Year	Date	Locality	OS Grid Ref.	Source
1999	Summer	Bradwell Ponds, Derbyshire	SK1782	Sorby Natural History Society Website
2000	11 Aug.	RAF Pit angling lake, off Skimmingdish Lane, Bicester, Oxfordshire	SP600254	*Oxford Mail* 11 Aug. 2000
2001	Summer	Victoria Quays, South Yorkshire Navigation Basin, Sheffield	SK3687	P. Hardy *pers. comm.*
2002	Mid-July. to 15 Sept	Hatfield Water Park, Doncaster, S. Yorkshire	SE6610; SE6710	Howes 2003, 2005a, 2005b
2003	July	Victoria Quays, South Yorkshire Navigation Basin, Sheffield	SK3687	P. Hardy *pers. comm.*
2003	7 & 8 July	Shatterford Lakes, Kidderminster, Worcs.	SO7981	M. Weldon *pers. comm.*
2003	28-30 July	Parkers Pool, Ketley, Telford, West Midlands	SJ6710	A. George *pers. comm.*
2003	1 & 2 Aug.	Bridgwater Dock, Bridgwater, Somerset	ST2937	Mrs P. M. Wright *pers. comm.*
2004	6-8 June	Bridgwater Dock, Bridgwater, Somerset	ST2937	Mrs P. M. Wright *pers. comm.*
2004	21 Aug.	Audenshaw Reservoir, Greater Manchester	SJ9096	J. A. King *pers. comm.*
2005	12-14 July	Radbrook Green Pond, Shrewsbury, Shropshire	SJ477113	Ms S. Lines *pers. comm.*
2005	July	Cricklade area (Cotswolds), Glos.	SU09	(Anon phone call)
2006	21 July	Monastery Dam, St. Helens, Merseyside	SJ49	A. Johnson *pers. comm.*
2006	25 July	Mill Lane Angling Pond, Failsworth, Greater Manchester	SD9101	T. Carrington & J. Boomer *pers. comm.*
2006	4 Aug.	Canal at Pennington Flash, Wigan	SJ6399	G. Workman & Tony Whittle *pers. comm.*; *Wigan Evening Post* 4.8.2006
2006	18 July	Caversham Gravel Pit, Reading, Berks.	SU745755	G. Meadows *pers. comm.*
2006	21-22 Aug.	Stanigal Water, Newbould, Leics.	SK4018	M. Grey *pers. comm.*

BOOK REVIEWS

Caribou and the North by **Monte Hummel** and **Justina C. Ray**. Pp. 288, colour illus. throughout. Dundurn Press, Toronto / Gazelle Books, Hightown, Lancaster. 2008. £29.00 hardback.

This most attractive book on caribou explains that there is just one species worldwide encompasses both caribou and reindeer. However, populations vary in physical characteristics and behaviour. In North America, five subspecies have traditionally been recognized based on body type of which woodland caribou and barren ground caribou are best known. This subspecies separation should be replaced by one that also takes account of behaviour and habitat. Large mammal scientists now talk about migratory tundra caribou, boreal forest caribou and mountain caribou, each having features that fit them to survive in their chosen habitat.

Caribou are the only deer in which both males and females bear antlers, but these are often absent in the females of migratory tundra populations such as the Peary caribou and Newfoundland caribou. In contrast, females in populations of the boreal forest caribou have well developed antlers. These enable them to fend off, intimidate or chase away other females or even males from craters that they have dug in the snow to search for lichens (their main winter food) and other fodder.

This fascinating book provides a large number of evocative colour photographs of caribou. To date, the survival of humans and caribou has been inextricably interwoven. The book describes the past, present and future pressures on caribou populations and what must be done to help ensure that they survive in the face of global warming, infrastructure construction and industrial developments. The text exhorts all parties that play a role in their management to persuade politicians to enact legislation that will ensure the future of these wonderful animals.

DHSR

Freshwater Megaloptera and Neuroptera of Britain and Ireland : keys to adults and larvae, and a review of their ecology by **J. M. Elliott.** Pp. 71. Freshwater Biological Association. Scientific Publication no. 65. 2009. £19.00 paperback, plus p. & p. [Available from: FBA, The Ferry Landing, Far Sawrey, Ambleside, Cumbria LA22 0LP.]

This booklet is the fifth edition of that produced by D. E. Kimmins 65 years ago as a key to those members of these primitive endopterygote insects, whose early stages are aquatic, that have been found in the British Isles. Only two species of *Sialis* (Alder flies) were then recorded: now there are three. Neuropteran representatives still consist of three species of *Sisyra* (Sponge flies) and one of *Osmylus*. Whether larvae of *Osmylus* are truly aquatic is arguable; their preference appears to be for wet moss. Adult Alder flies are familiar waterside insects, and their larvae are well known, at least to naturalists: the aquatic neuropterans – related to terrestrial families that constitute the Lacewing flies – perhaps less so. Larvae of *Sisyra* feed on freshwater sponges, or sometimes bryozoans.

The original line drawings of adult and earlier stages of the life history continue to give good service and are supplemented by more recent illustrations, including photographs of mating *Sialis*, and of clusters of eggs, which are deposited on waterside plants. Newly hatched larvae fall into the water or, if necessary, crawl there. Mature larvae of *Sialis* crawl ashore and pupate in damp soil or debris. The excellent drawing by Kimmins of a pupa of *S. lutaria* lying horizontally in a closed chamber is, however, not typical of all. Probably more lie vertically in an open chamber, and yet others in a different posture. The nature of the substratum may be the determinant.

Users of this well produced booklet are now not only provided with updated keys, but with a concise summary of the biology, and particularly the ecology and life cycles, of these insects, gathered from more than 130 listed sources and the personal experience of its author. Although highly competent, he uses the designation 'sp. nov.' when referring to the parasitic ciliate *Tetrahymena sialides* Batson, which emphasises the oft cited need for more education in taxonomy! Overall, however, this is an excellent publication. GF

THE SCALE INSECTS (HEMIPTERA: COCCOIDEA) OF WATSONIAN YORKSHIRE

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Abstract
An annotated list of 74 species of Coccoidea (35 native, 4 naturalised introductions, 24 introduced species established on indoor plantings, and 11 non-established introductions on growing plants), belonging to nine families, recorded in Watsonian Yorkshire is presented. Forty-four species, including several important plant pests, are recorded from the region for the first time. The largest number of scale insect species (20) was recorded from Strensall Common, 14 of which were recorded on Gramineae/Cyperaceae, eight on Fagaceae, seven on Rosaceae and four on Ericaceae. The plant species with the largest number of scale insects recorded on it was *Quercus robur* (7 species), followed by *Crataegus monogyna* (5), *Aesculus hippocastanum* (4) and *Sorbus aucuparia* (4).

Introduction

The purpose of this communication is to catalogue the scale insects (Hemiptera, Coccoidea) of Watsonian Yorkshire (VCs 61 to 65), based on published records and more than 850 samples collected primarily by the author since 1996.

Newstead (1892, 1901, 1903) was the first to publish records of scale insects found in Watsonian Yorkshire and listed six native species. Harrison (1915a, 1915b, 1916a, 1916b, 1918) surveyed the scale insects of Yorkshire and found 13 native and two non-native species (excluding species found only on imported fruit). Since 1916, however, there have been no further published lists of the scale insects for the region. Compiling the current list has been complicated by the fact that scale insects are one of the arthropod groups most commonly dispersed between countries as a consequence of international trade (Malumphy, 1996). They are also one of the most succesful in terms of invading new geographical areas (Pellizzari & Dalla Montá, 1997; Smith *et al.*, 2007; Thomas, 2004) and many species have become cosmopolitan due to anthropogenic activities. As a consequence non-native species are continually being accidentally introduced to Yorkshire on imported plant material. Previous British checklists of Coccoidea (e.g. Boratyński & Williams, 1964) have all included scale insect species found in association with imported plant material. However, only those non-native species found on growing plants have been included in this communication, as they have the potential of establishing, at least under artificial conditions. Non-native species found only on imported produce are excluded from this work as they are unlikely to survive for long and their inclusion has little scientific value. Large numbers of species have been found on imported citrus, custard apple, guava, mango and pineapple fruit in England (including Watsonian Yorkshire) and Wales by the Plant Health and Seeds Inspectorate (PHSI) of the Department of Enviroment, Food and Rural Affairs (DEFRA).

There are a tremendous variety of landforms within Watsonian Yorkshire, from acidic moorland and mountain limestone to chalk wolds and lowland clays. The landform, geology, land use and climate of the area are described and mapped by Sutton & Beaumont (1989).

Methods

Collecting was carried out by searching visually in the field. Apical twigs, leaf litter and moss were also collected randomly and examined under a low power microscope in order to find cryptic species, for example *Asterodiaspis* spp. and *Diaspidiotus* spp.. Collecting was possible throughout the winter, as many species remain attached to the host plant long after they have died, in some cases for more than a year.

Specimens collected since 1996 (when the author first started collecting in Yorkshire) are listed under 'Recent collections'. The majority of the field samples were collected from October 1996 to August 1998 and June 2007 to June 2008. They were collected and identified by the author unless otherwise stated. Some samples were collected by the PHSI during phytosanitary inspections and by staff at the Central Science Laboratory (CSL). Specimens were slide-mounted according to the methods given by Malumphy (2002) and deposited at the CSL. Records were also obtained from the literature and specimen depositories held by the CSL and the Natural History Museum, London (NHM). The nomenclature used here follows the catalogue of the Coccoidea of the World compiled by Y. Ben-Dov, D.R. Miller and G.A.P. Gibson available online at http://www.sel.barc.usda.gov/scalenet/scalenet.htm. Synonyms are included only if used in the references cited. Species recorded in Yorkshire for the first time are indicated thus *.

Results

A total of 74 species (35 native, 4 naturalised introductions, 24 introduced species established on indoor plantings, and 11 non-established introductions on growing plants) of Coccoidea are recorded here for Watsonian Yorkshire, belonging to nine families. Forty-four species (10 native and 34 non-native), including several important plant pests, are recorded from the region for the first time. The scale insect species have been divided into three sections: (1) native and introduced species that have become naturalized, (2) non-native species found breeding under artificial conditions, e.g. on indoor plantings, which are likely to be present in Britain for the foreseeable future, and (3) non-native species found only on imported growing plants, some of which have survived as transient populations for months or longer, but which are not known to have become established anywhere in Britain.

Native and non-native naturalized species

Thirty-five native species (1 Steingeliidae, 3 Ortheziidae, 3 Pseudococcidae, 12 Coccidae, 1 Kermesidae, 7 Eriococcidae, 3 Asterolecaniidae and 5 Diaspididae) and four non-native naturalized species (1 Pseudococcidae, 2 Coccidae and 1 Diaspididae) have been recorded in the region.

STEINGELIIDAE

* ***Steingelia gorodetskia*** Nassonov – Birch Bark Scale

This is a Palearctic, woodland species that feeds on the roots of *Betula*. It is very rarely recorded in Britain. The adult females usually come above ground to oviposit in leaf litter, at the base of birch trees, or on any available substrate. This has resulted in many inaccurate host plant records including numerous woody plant species, grasses, sedges and moss. Cecidomyid larvae are reported predating *S. gorodetskia* for the first time here, as no natural enemies have been previously recorded.

Recent collections. VC61: Black Plantation, *Betula pendula* base of tree, 6.v.2008 (single ovipositing female); Skipwith Common, *B. pendula* leaf litter, 20.vi.2008 (sparse, dead females and ovisacs). **VC62**: Buttercrambe Moor Wood, leaf litter at base of *B. pendula,* 8.v.2008 (single ovipositing female, being attacked by two *Lestodiplosis* larvae); Strensall, *Quercus robur* leaf litter near *B. pendula,* 15.v.2008 (several ovipositing females); Strensall Common, *B. pendula* base of trees, 6.v.2008 and 26.v.2008 (ovipositing females, abundant), *B. pendula* leaf litter, 6.v.2008 (dead male pupae, abundant) and 17.vi.2008 (abundant, dead females and ovisacs), *Calluna vulgaris* stem, 17.vi.2008 (single dead female with ovisac, together with *Phenacoccus aceris* (Signoret)), Gramineae live and dead, 26.v.2008 (sparse) and 17.vi.2008 (abundant, dead females with ovisacs), mixed leaf litter, 26.v.2008 (abundant), mosses, leaves and roots, 26.v.2008 (sparse) and inside a beetle larva exuvia, 26.v.2008 (single ovipositing female, being attacked by a *Lestodiplosis* larva).

ORTHEZIIDAE – Ensign Scales

Arctorthezia cataphracta (Olafsen) – Alpine Ensign Scale

Syn. *Orthezia cataphracta* (Olafsen)

This is a Holarctic, woodland, montane species that occurs in damp habitats. It is found

among mosses or lichens, or on the roots of a range of grasses and other herbaceous plants. It has been rarely recorded in Britain. Harrison (1915a, 1916) recorded it as widespread in North Yorkshire, preferring *Polytrichum* and *Sphagnum,* but also at the bases of Gramineae, Juncaceae and among dead leaves. Williams collected it in Malham (VC64) under moss, 23.vi.1956 (BMNH).

Newsteadia floccosa (de Geer) – Boreal Ensign Scale
This is a Palearctic, woodland species that occurs in damp habitats. It is found among mosses or lichens and leaf litter, or on the roots of a wide range of herbaceous and woody plants. It has been rarely recorded in Britain. Harrison (1915a, 1916a) recorded it in Easton (VC62) and as widespread in North Yorkshire, preferring drier spots. Williams collected it in Hawksworth Moor (VC62) on Gramineae (BMNH).
Recent collections. **VC62**: Strensall Common, in damp situations, moss, 23.vi.1997 (single female), amongst dead leaves, mosses and on the stem bases of *Erica tetralix* and Gramineae, 29.vi.1997 (abundant, patchy), *E. tetralix,* 7.vii.1997 and 24.viii.1998 (not found in the same locations during 2006-8). **VC64**: Bolton Abbey Estate, Cavendish Bridge, ?*Sphagnum*, 20.vii.1997, Valley of Desolation, under damp moss, 20.vii.1997.

Ortheziola vejdovskyi (Šulc) – Moss Ensign Scale
This is a Palearctic, woodland species that is recorded from both damp and dry habitats. It is found among mosses or on the roots of grasses and other herbaceous plants. It has been rarely recorded in Britain. Harrison (1915a) recorded it in Great Ayton Moor (VC62) as possibly a new species of *Orthezia* but later (1915b, 1916a) corrected his identification.

PSEUDOCOCCIDAE – Mealybugs
* ***Balanococcus diminutus*** (Leonardi) – Phormium Mealybug
Syn. *Trionymus diminutus* (Leonardi)
This species originates from New Zealand and was introduced to England in the 1970s (Bartlett, 1981). It has naturalized widely in England and Wales on *Phormium tenax*.
Recent collections. All records are on *P. tenax*. **VC61**: Beverley, plant nursery, 22.iv.2006 (PHSI). **VC62**: Sand Hutton, CSL, various dates, 2005 (R. Hammon) and 9.v.2008 (nymphs). **VC64**: Harrogate, 18.iv.2005 (R. Hammon); Leeds, 6.i.2000 (large populations killing ornamental plants in city center and in parks), plant nursery, 6.ix.2005.

Dysmicoccus walkeri (Newstead) – Walker's Mealybug
This is a Palearctic species that feeds on various herbaceous plants. It has rarely been recorded in Britain. Harrison (1915a) recorded it in Redcar and Marske-by-the-Sea (VC62), on *Ammophila arenaria* and other Gramineae.
Recent collection. **VC62**: Strensall Common, broad-leaved Gramineae, 2 and 26.viii.1998.

Phenacoccus aceris (Signoret) – Polyphagous Tree Mealybug
Syn. *Pseudococcus socius* Newstead
This is a Holarctic species that is polyphagous on trees and shrubs. It occurs widely and is locally common in Britain. Newstead (1892) recorded it from Wakefield (VC63), on *Ribes nigrum* (G. Parkin) and Williams (1962) from Adel, Leeds (VC64) on *Ulex europaeus*, 24.vi.1956.
Recent collections. **VC61**: Allerthorpe Common, *U. europaeus*, 25.vii.1998; Dunnington, *Acer pseudoplatanus*, 20.vi.2008 (sparse); Eddlethorpe Hall, *Fagus sylvatica* 'Purpurea', 24.vi.2008 (sparse); Selby, *Alnus* sp., *Quercus robur* and *Sorbus aria*, 20.vi.2008; Skipwith Common, *Q. robur*, 20.vi.2008 (sparse) and *U. europaeus*, 7.viii.1997; Stamford Bridge, *Acer campestre,* 4.vi.2008 (sparse, ovisacs) and *A. pseudoplatanus,* 19.v.2008 (single female with ovisac) and 4.vi.2008 (sparse). **VC62**: Buttercrambe, *A. pseudoplatanus*, 9.vi.2008 (sparse); Buttercrambe Moor Wood, *Fagus sylvatica*, 27.ii.2008 (single nymph) and *Sorbus aucuparia*, 11.vii.1997; Haxby, *Crataegus monogyna*, 1.xii.1996 and 18.vi.1997, *Q. robur*, 22.vi.1997, *S. aucuparia*, 19.vi.2008 and *S. aria*, 6.vi.2008 (single female with ovisac), Westwoods, *C. monogyna* and *Q. robur,* 31.v.2008 (females with ovisac); Howsham Bridge, *Aesculus hippocastanum*, 19.vi.2008; Scrogs Wood, *Q. robur,* 24.iv.2008; Sheriff Hutton,

A. pseudoplatanus, 22.vi.2008; Skelton, *Q. robur*, 8.vi.2008 (abundant); Strensall, *A. pseudoplatanus, Prunus avium* and *S. aria*, 13.vi.2008; Strensall Common, *A. pseudoplatanus*, 22 and 26.v.2008 (sparse, ovisac), *Betula pendula*, 26.v.1997 (abundant), 5.vii.1997 and 26.viii.1998, *Calluna vulgaris*, 17.vi.2008 (single female with ovisac; together with *S. gorodetskia*), *Q. robur*, 30.i.2008 (sparse), 27.ii.2008 and 21.iv.2008, and *U. europaeus* 22 and 26.v.2008 (sparse, females with ovisacs); Wigginton, *P. avium,* 7 and 13.vi.2008 (abundant), *Q. robur,* 7.vi.2008 (abundant), *Ribes uva-crispa*, 12.vii.2005 (L. MacLeod) and *S. aria*, 7.vi.2008 (sparse); York, city centre, *Acer palmatum*, 29.v.2008 (sparse) and *S. aucuparia* 12.vii.1997 (huge population, ovisacs numerous on the main trunk), New Earswick, *F. sylvatica*, 8.vi.2008 (sparse, ovisacs).

In addition, an adult male inside a waxy test, strongly suspected to be *P. aceris*, was found at Lockton Cemetery (VC 62) on the trunk of a *P. avium* tree, 25.iv.2008.

Trionymus perrisii (Signoret) – Perris' Grass Mealybug
Syn. *Pseudococcus hibernicus* (Newstead)
This is a Palearctic species that feeds on grasses. It has rarely been recorded in Britain. Green (1920) recorded it in Selby (VC61) in crevices of dead *Quercus* branches lying on turf, ix.1918 and Williams (1962) in Hawksworth (VC64), on Gramineae, 15.viii.1958 and 6.viii.1960.
Recent collection. **VC64**: Appletreewick Moor, Jack Hole Flat, Gramineae, 3.viii.1997 (single adult female).

COCCIDAE – Soft Scales
Williams collected a *Luzulaspis* sp. in Levisham (VC62) on Gramineae, 27.viii.1959, which differs from the two species listed below. The single specimen available for study, however, is in poor condition and cannot be identified with certainty. Newstead (1903) recorded *Physokermes piceae* (Schrank) (as *P. abietis* (Geoffroy)) in Leeds (VC64), on *Picea abies* and Harrison (1915b, 1916a, as *P. abietis*) recorded this species in Great Ayton, Marton and Nunthorpe (VC62) on *P. abies*. All specimens labelled *P. piceae*, however, in the collections at the BMNH and the CSL have recently been found by the author to be misidentifications of *P. hemicryphus* (Dalman). The presence of *P. piceae* in the region, therefore, requires confirmation.

Eriopeltis sp.
Newstead (1903) recorded *E. festucae* (Fonscolombe) as abundant in Huddersfield (VC63) (Mosley). According to Manawadu (1986), however, all the early records of *E. festucae*, may refer to any of the three native species of *Eriopeltis* now known to occur in Britain. The identity of the *Eriopeltis* sp. recorded in Yorkshire therefore requires confirmation.

* ***Eulecanium ciliatum*** (Douglas) – Ciliate Oak Scale
This is a Palearctic species that feeds on trees and shrubs, but is most commonly recorded on *Quercus* spp.
Recent collection. **VC62**: Strensall Common, *Quercus robur,* 27.ii.2008 (sparse).

Eulecanium tiliae (Linnaeus) – Nut Scale
This species occurs throughout Europe, the Middle East and North Africa and has been introduced to North America and Tasmania. It is broadly polyphagous on woody plants, and is most frequently found on Rosaceae. It is widespread and locally common in Britain and occasionally enormous populations develop, which may damage woody ornamentals and fruit trees. Harrison (1915a, 1916b) recorded it in Middlesborough (VC62) on *Crataegus* sp. and *Prunus spinosa*, and at Fairy Dell, near Middlesborough (VC62), on *Corylus avellana*.
Recent collections. **VC61**: Aldmoor Farm, *Acer pseudoplatanus*, 24.vi.2008 (sparse); Bugthorpe, *Malus domestica,* 27.vi.2008 (sparse); Burythorpe, *Prunus domestica*, 12.vi.1997; Norton, *Tilia x europaea,* 24.vi.2008 (abundant); Selby, *Fagus sylvatica,* 20.vi.2008 (huge population of male tests and post-reproductive females; 100% parasitism by hymenopteran parasitoids; two *Anthribus fasciatus* Förster adults emerged 15.vii.2008; a dipteran larva observed feeding inside a dead scale; *Anystis*

baccarum (Linnaeus) mites were observed feeding on first instars and on a hymenopteran pupa) and 28.vi.2008 (H. Anderson); Skipwith Common, *Quercus robur*, 20.vi.2008 (single adult); Stamford Bridge, *Crataegus monogyna*, 9.vii.1997. **VC62**: Garbutt Wood Nature Reserve, *C. monogyna*, 27.v.1997; Haxby, *Acer campestre*, 18.vi.1997, *C. monogyna*, 8.vi.2007, Westwoods, *C. monogyna*, 31.v.2008; Moorlands Wood Nature Reserve, *Q. robur*, 19.vii.1997; Sand Hutton, *Aesculus hippocastanum*, 20.vi.1997 and *Salix caprea*, 4.vi.2007; Skelton, *M. domestica*, 8.vi.2008 (single parasitized female; active first instars); Strensall Common, *Q. robur*, 18.vii.1997 and 2.vii.2008; Upper Helmsley, *C. monogyna*, 10.vii.1997; York, city centre, *A. pseudoplatanus* (enormous population of scales, smothering thin branches and apical twigs, high level of parasitism; no live scales were found on the same tree between 2000-2008) and *Tilia* sp., 13.vi.1998, Acomb, *A. pseudoplatanus*, 15.v.2008 (sparse, ant attended; R. Smith). **VC64**: Stamford Bridge, *C. monogyna*, 4.vi.2008 (single parasitized female).

* ***Lichtensia viburni*** Signoret – Viburnum Cushion Scale

This species is widespread in Europe on woody plants, most frequently on *Hedera* and *Viburnum*. It occasionally occurs in huge numbers, becoming a pest of ornamental plants.

Recent collections. All records on *Hedera helix* unless otherwise stated. **VC61**: Stamford Bridge, 11.i.2007 (huge infestation) and 19.v.2008 (sparse). **VC62**: Haxby, 4.vi.2007 (huge infestation, high level of parasitism), 27.ii.2008 and 11.v.2008 and *Rubus* sp., 6.vi.2007 (ovisacs only, probably non-host plant).

Luzulaspis dactylis Green – Green's Soft Scale

This is a European, woodland species that feeds on *Carex*. It is rarely recorded in Britain. Williams collected this species in Hawksworth (VC63) on Gramineae, 20.viii.1961 and Levisham (VC62) on Gramineae, 27.viii.1959 (BMNH).

Luzulaspis luzulae (Dufour) – Woodrush Scale

This is a Palearctic, woodland, montane species that is recorded on Cyperaceae, Gramineae and Juncaceae. It is widespread but rarely recorded in Britain. Hodgson (1994) recorded it in Goathland (VC62) on *Juncus squarrosus*, 25.viii.1959 (D. J. Williams) and Ickornshaw Moor (VC62), on Gramineae, 18.viii.1955 (A. Smith). It was also collected at Malham Tarn (VC64) on *Tortella tortuosa*, 8.x.1961 (T. G. Wood), Ilkley Moor (VC64) on Gramineae, 12.viii.1955 (A. Smith) and in Levisham on ?*Carex* sp., 27.viii.1959 (D. J. Williams) (BMNH).

Recent collections. The following records of ovisacs on Gramineae and Cyperaceae are possibly incidental and may not be true hosts. **VC62**: Strensall Common *J. squarrosus*, 20.vii.1997 (abundant on grazed and trampled plants), various dates viii.1997 (not found in the same location during 1998), *Carex elata* and *Molinea caerulea*, 30.viii.1997 (single ovisacs). **VC64**: Appletreewick Moor, Jack Hole Flat, *J. squarrosus*, 3.viii.1997; Ilkley Moor, *J. squarrosus*, 20.vii.1997 (abundant but localized) and 29.viii.1998, and *Deschampsia flexuosa*, 29.viii.1998 (single ovisac).

Palaeolecanium bituberculatum (Targioni-Tozzetti) – Bituberculate Scale

Syn. *Lecanium bituberculatum* (Targioni-Tozzetti)

This is a Western Palearctic species that feeds on Rosaceae. It occurs widely in Britain but is rarely recorded. Harrison (1915a) recorded this species in Middlesborough (VC62) on *Crataegus*.

* ***Parthenolecanium corni*** (Bouché) – European Fruit Lecanium

This species occurs widely in temperate regions and is broadly polyphagous on woody plants. It is locally common throughout Britain and a pest of numerous ornamental plants and fruit crops.

Recent collections. **VC61**: Dunnington, *Euonymus japonica*, 21.xi.1996 (J. Ostojá-Starzewski); Escrick, *Ribes sanguineum*, 20.vi.2008 (abundant); Norton, *R. sanguineum*, 24.vi.2008 (abundant; attended by the ant *Lasius niger* (L.)). **VC62**: Haxby, *Corylus avellena*, 31.v.2008 and 4.vi.2008 (abundant; attended by *L. niger*), *Crataegus monogyna*, 15.v.2008, *Malus domestica*, 6.vii.1997 and *Salix caprea*, 8.vi.2007; Pickering, *Pyracantha coccinea*, 25.iv.2008 (abundant).

* ***Parthenolecanium pomeranicum*** (Fabricius) – Yew Scale
This is a European species that feeds on *Taxus*. It occurs widely in Britain, but is rarely recorded.
Recent collections. **VC62**: Nunnington, *Taxus baccata*, 4.xii.2007 (abundant) and 22.v.2008 (R. Hammon); Sand Hutton, CSL, *T. baccata*, 24.vi.2008 (abundant) (J. Ostojá-Starzewski).

Physokermes hemicryphus (Dalman) – Small Spruce Bud Scale
This is a European species that has been introduced to North America. It feeds on *Picea*, and rarely on *Abies*. It occurs widely in Britain, but is rarely recorded. Malumphy (2009) showed that many early records of *P. piceae* were actually *P. hemicryphus*.
Recently collections. **VC61**: Elvington, *Picea abies*, 25.vii.1998 (sparse); Hagg Wood, 20.vi.2008 (single adult); Stamford Bridge, *P. abies*, 11.i.2007 (huge population, causing dieback), 31.i.2007, 19.vii.2007 (parasitised by *Aphycoides clavellatus* (Dalman) (Encytidae), *Aprostocetus ?trjapitzini* (Kostjukov) (Eulopidae), *Microterys lunatus* (Dalman) (Encrytidae); predated by *Anthribus* sp. (Anthribidae)), 18.x.2007, 2.xi.2007, 19.v.2008 (teneral adult females and small numbers of first instars), and 4.vi.2008.

* ***Pulvinaria floccifera*** (Westwood) – Cottony Camellia Scale
This is a polyphagous pest that originates in Asian but has now become cosmopolitan. It is widely naturalized in southern England and Wales.
Recent collections. **VC61**: Dunnington, *Ilex aquifolium* and *Taxus baccata*, 20.vi.2008; Elvington, *Euonymus japonica*, 11.vi.2007 (abundant) (D. Pye); Low Catton, *I. aquifolium*, 20.v.2008. **VC62**: Haxby (at several locations), *I. aquifolium*, 20.vi.2007 (abundant ovisacs), 31.v.2008 (ovisacs) and 12-13.vi.2008; Nunnington, *T. baccata*, 22.v.2008 (R. Hammon) and *I. aquifolium*, 11.vi.2008 (R. Hammon); Sand Hutton, *I. aquifolium*, 28.v.2008 (abundant); Strensall, *I. aquifolium* and *T. baccata*, 13.vi.2008 (abundant); Wigginton (at several locations), *I. aquifolium*, 7.vi.2008, 13.vi.2008 (abundant) and 16.vi.2008 (abundant); York, Fulford, *E. japonica*, 27.viii.1997 (L. MacLeod), Holgate, *I. aquifolium* and *T. baccata*, 15.vi.2008 (abundant), New Earswick, *T. baccata*, 8.vi.2008 (females with fully formed ovisacs). **VC64**: York, city centre, *I. aquifolium*, 3.v.2008 (abundant).

* ***Pulvinaria regalis*** Canard – Horse-chestnut Scale
This is a broadly polyphagous species that probably originates in Asia, but has become widespread in central and northwest Europe since the 1960s. Only the earliest collection dates are listed for each locality in order to shorten the large number of records.
Recent collections. **VC61**: Aldmoor Farm, *Acer pseudoplatanus*, 24.vi.2008 (sparse); Brayton, *A. pseudoplatanus* and *Ulmus* sp., 20.vi.2008; Bridlington, *A. pseudoplatanus* and *Tilia* spp., 5.vii.2008 (abundant); Bugthorpe, *A. pseudoplatanus,* 27.vi.2008 (sparse); Burythorpe, *A. pseudoplatanus*, 24.vi.2008 (sparse); Dunnington, *A. pseudoplatanus, A. pseudoplatanus* 'Atropurpurea', *Aesculus hippocastanum*, *Tilia cordata* and *Tilia x europaea*, 20.vi.2008; Escrick, *A. pseudoplatanus* and *T. x europaea*, 20.vi.2008; Hagg Wood, *A. pseudoplatanus,* 23.vii.1998 (sparse); Leavening, *A. pseudoplatanus*, *T. cordata* and *T. x europaea,* 24.vi.2008 (sparse); Norton, *T. x europaea*, 24.vi.2008 (sparse); Rudston, Thorpe Hall, *A. pseudoplatanus,* 12.vii.2008 (sparse); Selby, *Acer campestre, Acer palmatum, Acer platanoides*, *A. pseudoplatanus, Acer* sp., *A. hippocastanum*, *Fagus slyvatica* (single ovisac), *T. cordata, T. x europaea* and *Ulmus procera*, 20.vi.2008; Skipwith, *A. pseudoplatanus*, 20.vi.2008; Stamford Bridge, *A. campestre* and *A. pseudoplatanus*, 4.vi.2008. **VC62**: Barton-Le-Street, *A. pseudoplatanus* and *A. hippocastanum*, 22.vi.2008; Bulmer, *A. pseudoplatanus*, 22.vi.2008; Buttercrambe, *A. pseudoplatanus*, 9.vi.2008; Harton, *A. platanoides* and *A. pseudoplatanus*, 17.vi.2008 (sparse); Harton Lodge Plantation, *T. cordata,* 17.vi.2008; Haxby (widespread), *A. campestre*, 4.vi.2008, *A. campestre* 'Queen Elizabeth', 12.vi.2008 (huge population), *A. palmatum* 'Dissectum', 4.vi.2008, *A. platanoides, A. pseudoplatanus, Aesculus hippocastaneum* and *T. cordata*, 27.ii.2008; Haxby Grange Farm, *A. pseudoplatanus*, 22.vi.2008; Howsham Bridge, *Ulmus* sp., 19.vi.2008 (sparse); Malton, *A. pseudoplatanus, Euonymus japonica, T. cordata* and *T. x europaea*, 22.vi.2008; Moorlands Wood Nature Reserve, *A. palmatum* 'Atropurpurea' and 'Dissectum', and *A. pseudoplatanus*, 19.vii.1997; Rye Hills farm, *T. cordata* and *T. x europaea*, 22.vi.2008; Sandburn Wood, *A. pseudoplatanus,* 5.vi.2008; Sand Hutton, *A. pseudoplatanus* and *A. pseudoplatanus* 'Atropurpurea', 19.vi.1997, woods near Gravel Pit Farm, *A. pseudoplatanus*, 30.iv.2008; Sheriff Hutton, *A. pseudoplatanus*, *A. pseudoplatanus* 'Atropurpurea' and *A. hippocastaneum*, 22.vi.2008; Skelton, *A. pseudoplatanus*, *A. pseudoplatanus* 'Atropurpurea' and *A. hippocastanum,* 8.vi.2008; Strensall Common, *A. pseudoplatanus*, 26.v.2008 (sparse); Sutton-on-the-Forest, *A. pseudoplatanus*,

A. pseudoplatanus 'Atropurpurea' and *T. x europaea,* 26.v.2008; Thorton Le Dale, *A. pseudoplatanus, A. hippocastanum* and *Tilia* spp., 25.iv.2008; Wide Open Farm, *A. pseudoplatanus,* 8.vi.2008; Wigginton, *A. campestre* and *A. pseudoplatanus,* 7.vi.2008; Willowbridge Wood, *Populus tremula,* 15.v.2008 (single adult); York, city centre (widespread), *Acer negundo, A. palmatum, A. palmatum* 'Dissectum', *A. platanoides, A. pseudoplatanus, Acer* spp., *A. hippocastanum, Fatsia japonica* (G. Bloemers), *Rhus typhina, T. cordata, T. x europaea, Tilia* spp., *Ulmus carpinifolia* and *U. procera* and *Ulmus* spp., 6.x.1996, Clifford, *A. pseudoplatanus, A. hippocastanum* and *Tilia* spp., 24.v.2008, Clifton Moor, *A. hippocastanum* and *Tilia* spp., 4.v.2008, Holgate, *Acer palmatum* 'Dissectum', *A. pseudoplatanus, A. hippocastanum* and *T. cordata,* 15.vi.2008, Monk's Cross, *A. platanoides,* 1.vi.2008, New Earswick, *A. platanoides, A. pseudoplatanus, T. cordata* and *U. procera,* 8.vi.2008 and *T. x europaea,* 23.vi.2008 (sparse). **VC63**: Outwood, *A. pseudoplatanus,* 5.vii.2008 (abundant). **VC64**: shopping centre south of York, *A. platanoides* and *A. hippocastanum,* 14.vi.2008 (sparse); Leeds, Roundhay Park, *A. pseudoplatanus* and *T. cordata,* 28.vi.2008 (sparse); York, city centre (widespread), *A. pseudoplatanus, A. hippocastanum, Tilia* spp. and *Ulmus* sp., 16.xi.1996.

Pulvinaria vitis (Linnaeus) – Woolly Vine Scale
Syn. *Pulvinaria ribesiae* Signoret; *P. vitis* var. *ribesiae* (Signoret)
This is a Palearctic species that has been introduced to North America. It is broadly polyphagous and a pest of grapevine, peach and currants. It is locally common throughout Britain. Newstead (1892, 1903) recorded it in Huddersfield and Wakefield (VC63) on *Ribes nigrum* (Omerod; Geo Parkin) and in Doncaster (VC63) (Corbett).
Recent colelctions. **VC61**: Dunnington, *Crataegus monogyna*, 4.xi.1996. **VC62**: Buttercrambe, *Alnus glutinosa*, 9.vi.2008 (single parasitized female with ovisac); Garbutt Wood Nature Reserve, *Betula pendula*, 27.v.1997; Haxby, *Prunus spinosus*, 18.vi.1997, *Pyracantha coccinea*, 4.x.1996; Sand Hutton, *C. monogyna,* 15.vii.1998 and 22.v.2008 (female with ovisac); Strensall Common, *B. pendula,* 3.ii.1997; York, city centre, *Cotoneaster* sp., 6.x.1996 and *C. monogyna,* 6.x.1996, 16.xi.1996 and 22.viii.1998. **VC64**: York, city centre, *C. monogyna,* 16.xi.1996.

Vittacoccus longicornis (Green) – Long-horned Scale
This is a Palearctic, woodland species that feeds on *Carex*. It occurs widely in Britain, but is rarely recorded. Hodgson (1994) recorded it in Goathland (VC62), 25.viii.1959 (D. J. Williams).

KERMESIDAE – Gall-like Scales
Kermes quercus (Linnaeus) – Striped Kermes
This is a European species that feeds on *Quercus*. It occurs widely in Britain, but is rarely recorded. Green (1920) collected it in Selby, Staynor Hall Wood (VC61), in profusion on adventitious buds on the stem of a single *Quercus* sp. and a few individuals on other oaks, ix.1918.

ERIOCOCCIDAE – Felt Scales
Cryptococcus fagisuga Lindinger – Beech Scale
Syn. *Cryptococcus fagi* (Bärensprung)
This is a European species that has been introduced to North America. It feeds on *Fagus* and occurs throughout Britain, frequently in very high densities. It is associated with the transmission of beech bark disease caused by *Nectria coccinea* var. *faginata* Lohman, Watson & Ayers and *Neonectria galligena* (Bres.) Rossman & Samuels (Ascomycota: Hypocreales: Nestriaceae). *Cryptococcus fagisuga* has been recorded in Guisbrough Park Wood near Ormesby and Marton (VC62) by Harrison (1915a); in Headingley (VC64) (Eardly Mason) and Leeds (VC64) by Newstead (1903); and in Bingley (VC64), 10.x.1933 (G. Fox-Wilson) and Hardcastle Craggs, near Harrogate (VC64), 22.viii.1961 (D. J. Williams) by Williams (1985).
Recent collections. All records were on *Fagus sylvatica*. **VC61**: Burythorpe, 11.v.1997; Dunnington, *F. sylvatica* 'Purpurea', 20.vi.2008; Low Catton, 20.v.2008; Rudston, Thorpe Hall, 12.vii.2008. **VC62**: Abbey Bank Noodle, 2.xi.1996; Beningbrough, 7.viii.1998; Bugthorpe, *F. sylvatica* 'Purpurea', 27.vi.2008; Buttercrambe Moor Wood, 19.vi.1997 and 21.vii.1998 (predated by the coccinelid larva of *Chilocorus renipustulatus* Rossi); Byland Abbey, 2.xi.1996; Claxton, 23.iv.2008; Elm Hag, 2.xi.1996;

Goathland, 31.v.1997; Harton Lodge Plantation, 17.vi.2008; Haxby, 8.vi.2007 (sparse), 11.iv.2008 and 12.vi.2008; Kirbymoorside, 12.ii.1997; Lockton, 25.iv.2008; Moorlands Wood Nature Reserve, 19.vii.1997, 22.iv.2008 and 24.v.2008; Rievaulx Abbey, 10.v.2008; Ripley, 3.viii.1997; Sand Hutton (several locations), 4.xi.1996, 19-20.vi.1997, 22.v.2008 (abundant) and 2.vi.2008 (huge infestation); Skelton, 8.vi.2008; Strensall Common, 22-26.v.2008 (abundant); Sutton Bank, South Woods, 27.v.1997; Sutton-on-the-Forest, 26.v.2008 (abundant); Thorton Le Dale, 25.iv.2008; Upper Helmsley, 10.vii.1997; Wass, 2.xi.1996; Wigginton, 31.v.2008, 2.vi.2008 (huge infestation) and 13.vi.2008; York, City centre, 8.vi.1997 and 12.vii.1997, New Earswick, 8.vi.2008. **VC64**: Bolton Abbey Estate, Waterfall Cottage, 20.vii.1997; Fountains Abbey, 6.viii.1997; Glasshouses, Nidderdale Way, 25.v.2008; Ilkley Moor, 20.vii.1997 and 29.viii.1998; Leeds, Roundhay Park, 21.vi.1997 and *F. sylvatica* 'Purpurea', 28.vi.2008; York, Rowntree Park, 16.xi.1996.

Eriococcus devoniensis (Green) – Heather Felt Scale

This is a European species that feeds on Ericaceae. It occurs widely in Britain, but is rarely recorded. It causes characteristic distortion of the stem on *Erica* spp., especially *E. tetralix*, resulting in the stem curling tightly around the insect. It has been recorded in Moorlands, Easton (VC62) and North Yorkshire by Harrison (1916a, 1916b, 1918); Goathland (VC62), 25.viii.1959, Levisham (VC62), 27.viii.1959 (D. J. Williams), Ickornshaw Moor (VC62), 29.viii.1948 (A. Smith), Hawksworth (VC63), 12.viii.1960 (D. J. Williams) and Shipley Glen (VC63), 25.viii.1984 (N. B. Pungerl) by Williams (1985).

Recent collections. All records were on *E. tetralix*. **VC61**: Allerthorpe Common, 25.vii.1998; Skipwith Common, 7.viii.1997 (abundant) and 20.vi.2008 (nymphs, abundant). **VC62**: Strensall Common, various dates during vii-viii.1997, viii.1998 (abundant), 11.vi.2007 and 6.v.2008 (abundant), 17.vi.2008 (early stem distortion, first and second instars), 2.vii.2008 (teneral adults) and old galls on *Calluna vulgaris*, 2.vii.2008 (sparse).

Eriococcus greeni Newstead – Newstead's Felt Scale

This is a European species that feeds on Gamineae; it is rarely recorded in Britain. Williams (1985) recorded it in Hawksworth (VC63), on Gramineae, 20.viii.1961 (D. J. Williams).

Recent collection. **VC62**: Strensall Common, Gramineae, 26.viii.1998 (single female with ovisac).

Eriococcus inermis Green – Harmless Felt Scale

This is a European species that feeds on Gramineae. It is rarely recorded in Britain. Williams (1985) recorded it in Hawksworth (VC63), on Gramineae, 20.viii.1961 (D. J. Williams) and Steeton Moor (VC64), 29.viii.1948 (A. Smith).

Eriococcus insignis Newstead – Conspicuous Felt Scale

This is a European species that feeds on Gramineae. It is rarely recorded in Britain. Williams (1985) recorded it in Goathland (VC62), 25.viii.1959 (D. J. Williams).

Eriococcus pseudinsignis Green – Boreal Felt Scale

This is a European species that feeds on Gramineae. It is rarely recorded in Britain. Williams (1985) recorded it in Ickornshaw Moor (VC62), x.1958 (A. Smith) and Steeton Moor (VC64), 29.viii.1948 (A. Smith).

Recent collection. **VC62**: Strensall Common, Gramineae, 21.vii.1997 (sparse).

Pseudochermes fraxini (Kaltenbach) – Ash Bark Scale

Syn. *Apterococcus fraxini* Newstead

This is a European species that feeds on *Fraxinus*. It occurs throughout Britain, frequently in very high densities together with *Chionaspis salicis* (Linnaeus). It was recorded as a pest of ash in Yorkshire by Collinge (1937). Harrison (1916a) recorded it in Middlesbrough and Nunthorpe (VC62) and Williams (1985) in Leeds, Adel (VC64), 2.vii.1963.

Recent collections. All records were on *Fraxinus excelsior*. **VC61**: Burythorpe, 11.v.1997; Dunnington, 4.xi.1996 and 20.vi.2008; Elvington, 2.vii.1998; Low Catton, 20.v.2008; Rudston, Thorpe Hall, 12.vii.2008 (heavy infestation); Selby, 20.vi.2008 (heavy infestation); Skipwith, 20.vi.2008;

Stamford Bridge, 9.vii.1997 and 19.v.2008. **VC62**: Beningbrough, 7.viii.1998; Buttercrambe, 9.vi.2008; Buttercrambe Moor Wood, 1 and 11.vii.1997; Elm Hag, 2.xi.1996; Fangdale Beck, 13.vii.1997; Garbutt Wood Nature Reserve, 27.v.1997; Grange Wood, 1.vii.2008 (abundant); Harton Lodge Plantation, 17.vi.2008; Haxby (several locations), 24.x.1996, 18.vi.1997, 8.vi.2007, and various dates ii-vi.2008; Hole of Horcum, 25.iv.2008; Howsham Bridge, 19.vi.2008; Lockton, 25.iv.2008; Moorlands Wood Nature Reserve, 19.vii.1997 and 22.iv.2008; Ripley, 3.viii.1997; Sand Hutton, 6.xii.1996, 19.v.1997, 7.vii.1997, 4.viii.1998 and 22.v.2008 (abundant); Scrogs Wood, 28.iv.2008; Sheriff Hutton, 22.vi.2008; Skelton cemetery, 8.vi.2008; Strensall Common, 24.viii.1998 and 22-26.v.2008; Sutton Bank, South Woods, 27.v.1997; Sutton-on-the-Forest, 26.iv.2008; Thorton Le Dale, 25.iv.2008; Upper Helmsley, 10.vii.1997; Wass, 2.xi.1996; Wigginton, 31.v.2008 and 7-13.vi.2008; Willowbridge Wood, 15.v.2008; York, city centre, 12.vii.1997, Huntingdon Cemetery, 22.iv.2008, St. George's Field, 16.xi.1996. **VC64**: Askham Bog, 1.viii.1998; Glasshouses, Nidderdale Walk, 9.ii.2008, (predated by the coccinelid *C. renipustulatus* adult) 25.v.2008; Ilckley Moor, 20.vii.1997 and 29.viii.1998; Leeds, Roundhay Park, 21.vi.1997 and 28.vi.2008; Stamford Bridge, 4.vi.2008; York, city centre, 16.xi.1996, Rowntree Park, 16.xi.1996.

ASTEROLECANIIDAE – Pit Scales

There is disagreement in the literature regarding the number and generic placement of the Pit Scales feeding on *Quercus* spp. in Britain. The taxonomy and nomenclature used here follows Boratyński (1961), who recognize three species: *Asterodiaspis quercicola* (Bouché), *A. mina* (Russell) and *A. variolosa* (Ratzeburg). Some authorities assign these species to the genus *Asterolecanium* and consider *A. mina* (= *A. minus* (Leonardi)) a junior synonym of *A. quercicola*. Boratyński (1961) found *A. mina* to be the most abundant species in Surrey, followed by *A. quercicola* and *A. variolosa*, whereas in North Yorkshire the opposite situation occurs, with *A. variolosa* the most abundant and *A. mina* the least. All three species produce 'pit galls' in the bark. Occasionally *A. quercicola* was found together on the same oak twigs as *A. variolosa* in North Yorkshire. Many of the *Asterodiaspis* samples could not be identified to species due to parasitism or they were in too poor a condition and are not listed below.

* ***Asterodiaspis mina*** (Russell) – Small Pit Scale

This is a western Palearctic species that has been introduced to North America. It feeds on *Quercus* and is locally common in southern Britain.

Recent collections. All records were on *Quercus robur*. **VC62**: Sand Hutton, 28.v.2008 (single adult); Strensall Common, 28.v.2008 (single adult).

* ***Asterodiaspis quercicola*** (Bouché) – Golden Pit Scale

This is a western Palearctic species that has been introduced to North America, South Africa, New Zealand and Mauritania. It feeds on *Quercus* and is common throughout Britain.

Recent collections. All records were on *Quercus robur*. **VC61**: Escrick, 20.vi.2008 (first instars); Hagg Wood, 20.vi.2008 (first instars); Low Catton, 20.v.2008; Selby, 20.vi.2008 (first instars); Skipwith Common, 7.viii.1997. **VC62**: Goathland, 31.v.1997; Haxby, 1.xii.1996 and 9.iv.2008; Sandburn Wood, 5.vi.2008; Sand Hutton, 21.xi.1996, 4.xii.1996 and 7.vii.1997; Scrogs Wood, 24.iv.2008; Strensall Common, 26.v.1997, various dates iv-v.2008; Wigginton, 7.vi.2008 (huge population damaging a young tree). **VC64**: Leeds, Roundhay Park, 21.vi.1997.

* ***Asterodiaspis variolosa*** (Ratzeburg) – Pit-making Oak Scale

This is a western Palearctic species that has been spread so widely that it has become almost cosmopolitan. It feeds on *Quercus* and is very common throughout Britain. In Yorkshire, it has occasionally been found in high densities, causing numerous pit galls.

Recent collections. All records were on *Quercus robur*. **VC61**: Allerthorpe Common, 25.vii.1998; Black Plantation, 6.v.2008; Escrick, 20.vi.2008 (abundant; first instars); Skipwith Common, 20.vi.2008 (abundant). **VC62**: Buttercrambe Moor Wood, 27.ii.2008 and 8.v.2008; Gate Helmsley Common, 21.iv.2008; Haxby, 24.x.1996, 23.iv.2008 and 31.v.2008; Howsham Bridge, 20.vi.2008; Moorlands Wood Nature Reserve, 19.vii.1997; Sand Hutton, 28.v.2008, Black Dike Plantation, 28.iii.2007 and 14.ii.2008, CSL, 21.xi.1996 and 8.iv.2008; Scrogs Wood, 24-28.iv.2008; Strensall Common, 7.vii.1997,

11.vii.1997, 4.vi.2007 and various dates i-vii.2008; Sutton-on-the-Forest, 26.iv.2008 and 26.v.2008; Thorton le Dale, 25.iv.2008; Upper Helmsley, 10.vii.1997; Whey Carr Plantation, 22.v.2008; Wigginton, 28.i.2008; York, New Earswick, 26.v.2008 (huge infestation, including a branch that had fallen from about 5 m up a tree). **VC64**: Leeds, Roundhay Park, 21.vi.1997; Redhouse Wood, 11.v.2008.

DIASPIDIDAE – Armoured Scales

**** Carulaspis minima*** (Targioni-Tozzetti) – Minute Cypress Scale

Syn. *Diaspis juniperi* Bouché – misidentification by Newstead (1900).

This is a Mediterranean species that has been introduced to West Africa, Hawaii, North and South America, and the Caribbean. It feeds on Cupressaceae and was first detected in Britain by Newstead in 1898 at the Royal Botanic Gardens, Kew (Newstead, 1900, 1901). It was previously restricted to a few localities in southern England (on ornamental plants in botanical collections) (Boratyński, 1957; the author's unpublished records). The following record for *C. minima* is the most northerly in Britain for this species. The two *Carulaspis* species naturalized in Britain have been studied in detail by Boratyński (1957).

Recent collections. **VC62**: Sutton-on-the-Forest, Sutton Park, *Juniperus virginiana*, 26.iv.2008 (enormous population causing chlorosis) and 26.v.2008, *Chamaecyparis lawsoniana*, 26.v.2008 (sparse).

Chionaspis salicis (Linnaeus) – Willow Scale

This is a Palearctic species that has been introduced to parts of Asia and North America. It is polyphagous on woody plants and a minor pest of currant bushes and willow. It is frequently found in very high densities in Yorkshire, particularly on *Fraxinus excelsior* (together with *Pseudochermes fraxini*) and *Salix* spp. Harrison (1915a, 1916a) recorded it near Middlesbrough (VC62) on *F. excelsior* and *Salix aurita*, and subsequently as abundant throughout North Yorkshire. Newstead (1901) recorded it as common near Leeds (VC63-64).

Recent collections. **VC61**: Allerthorpe Common, *Salix* sp., 25.vii.1998; Dunnington, *Fraxinus excelsior*, 4.xi.1996 and 20.vi.2008 (abundant); Elvington, *F. excelsior*, 25.vii.1998; Hagg Wood, *F. excelsior*, 23.vii.1998; Selby, *F. excelsior*, 20.vi.2008; Skipwith Common, *Salix caprea*, 7.viii.1997; Stamford Bridge, *F. excelsior*, *Populus* sp. and *Salix alba*, 9.vii.1997 and *S. alba*, 19.v.2008. **VC62**: Abbey Bank Noodle, *F. excelsior*, 2.xi.1996; Bosendale Wood, *F. excelsior*, 15.v.2008; Bossall, woods to the south, *F. excelsior*, 14.v.2008; Buttercrambe, *Alnus glutinosa* and *F. excelsior*, 9.vi.2008 (sparse); Buttercrambe Moor Wood, *Sorbus aucuparia*, 11.vii.1997; Byland Abbey, *F. excelsior*, 2.xi.1996; Elm Hag, *F. excelsior*, 2.xi.1996; Gate Helmsley Common, *F. excelsior*, 21.iv.2008; Goathland, *F. excelsior* and *Salix* sp., 31.v.1997; Haxby, *F. excelsior*, 4.x.1996, *S. caprea*, 24.x.1996 and 8.vi.2007 (huge population causing considerable dieback and the tree was removed in 2008), Landing Lane, *F. excelsior*, 23.iv.2008; Howsham Bridge, *F. excelsior* and *S. caprea*, 19.vi.2008; Hole of Horcum, *F. excelsior* and *Salix* sp., 25.iv.2008; Kirbymoorside, *F. excelsior*, 12.ii.1997; Lockton cemetery, *Salix* sp., 25.iv.2008; Moorlands Wood Nature Reserve, *F. excelsior, Ribes nigrum* and *S. caprea*, 19.vii.1997; Nunnington, *F. excelsior*, 30.xi.1997 (R. Hammon); Oldstead, *S. caprea*, 2.xi.1996; Sand Hutton, *F. excelsior* 22.v.2008 (abundant), CSL, *F. excelsior* (abundant), various dates iv-vi.2008, Black Dike Plantation, *Alnus glutinosa*, 29.i.1997, *F. excelsior*, 29.i.1997, 7.vii.1997, 4.viii.1998 and 14.ii.2008, *S. caprea*, 4.xii.1996, *Salix* sp., 29.i.1997, 22.viii.1998 and 14.ii.2008; Snever Wood, *S. caprea*, 2.xi.1996; Strensall, *F. excelsior*, 13.vi.2008; Strensall Common, *F. excelsior*, 24.viii.1998, *Prunus spinosa* and *S. alba*, 11.vii.1997, *S. caprea*, 26.v.1997, 11.vii.1997, 18.vii.1997 and 30.viii.1998; Sutton-on-the-Forest, *S. caprea*, 26.v.2008; Upper Helmsley, *F. excelsior*, 10.vii.1997 and 28.vii.1998, *P. tremula*, 10.vii.1997; Wass, *F. excelsior,* 2.xi.1996; York, cemetery, *F.* excelsior and *R. nigrum*, 12.vii.1997, Huntingdon Cemetery, *F.* excelsior, 22.iv.2008 (huge population), St. George's Field, *F. excelsior*, 16.xi.1996. **VC64**: Askham Bogs, *A. glutinosa, F. excelsior* and *Salix* sp., 1.viii.1998; Bolton Abbey Estate, Valley of Desolation, *A. glutinosa,* 20.vii.1997; Fountains Abbey, *F. excelsior*, 6.viii.1997; Glasshouses, Nidderdale Way, *F. excelsior*, 25.v.2008 (being predated by the coccinelid adult *Chilocorus renipustulatus*) and *S. caprea*, 25.v.2008, and *Tilia* sp., 9.ii.2008; Ilckley, *F. excelsior*, 20.vii.1997; Redhouse Wood, *S. caprea*, 11.v.2008; Leeds, Roundhay Park, *F. excelsior*, 28.vi.2008 (abundant); York, city centre, *F. excelsior* and *Salix* sp., 16.xi.1996.

* ***Diaspidiotus bavaricus*** (Lindinger) – Blueberry Armoured Scale

This is a European species that feeds on members of the Ericaceae. It occurs widely in

Britain but is rarely recorded, possibly because it is remarkably cryptic, often being hidden beneath peeling bark, bracts and algae growing on the stems of heather. Large numbers of scales were observed on individual heather plants when plant samples were examined in the laboratory.

Recent collections. All records were on *Calluna vulgaris*. **VC61**: Allerthorpe Common, 25.vii.1998; Skipwith Common, 7.viii.1997. **VC62**: Strensall Common, 5.vii.1997 (patchy, abundant), 22.viii.1998, 8.vi.2007, 17.vi.2008 (high levels of parasitism) and 2.vii.2008.

Diaspidiotus zonatus (Frauenfeld) – Zonate Armoured Scale

Syn. *Aspidiotus zonatus* (Frauenfeld)

This is a European species that feeds on woody plants, but is most frequently found on *Quercus*. It occurs widely in Britain but is rarely recorded, possibly because it is highly cryptic. Harrison (1915a) recorded this species in Nunthorpe (VC62) on *Quercus* sp..

Recent collections. All records are on *Quercus robur*. **VC61**: Black Plantation, 6.v.2008; Dunnington, Hagg Wood, 23.vii.1998; Escrick, 20.vi.2008 (abundant); Skipwith Common, 7.viii.1997 (huge infestation on single tree, causing severe distortion and drying out) and 20.vi.2008. **VC62**: Barnby Ho, 15.v.2008; Buttercrambe Moor Wood, 21.vii.1998; Gate Helmsley Common, 21.iv.2008 (abundant); Howsham Bridge, 19.vi.2008; Sandburn Wood, 5.vi.2008; Sand Hutton, 4.viii.1998; Strensall Common, various dates v-viii.1997 (abundant, strongly clumped distribution), 24.viii.1998, 4.vi.2007, various dates i-ii, v-vii.2008 (first instars from early June and second instars from beginning of July); Wigginton, 7.vi.2008 (huge infestation; first instars active). **VC64**: Askham Bogs, 1.viii.1998; Redhouse Wood, 11.v.2008.

Dynaspidiotus britannicus (Newstead) – Holly Scale

Syn. *Aspidiotus britannicus* (Newstead)

This is a Palearctic species that has been introduced to North and South America. It is broadly polyphagous and occurs widely in Britain, but is rarely recorded. Harrison (1915b, 1916a) recorded it in Middlesborough Park (VC62) on *Ilex aquifolium*.

Lepidosaphes ulmi (Linnaeus) – Mussel Scale

This is a Paleartic species that has spread widely throughout the temperate regions of the world. It is common throughout Britain and is broadly polyphagous on woody hosts, with a preference for plants belonging to the Rosaceae. It is a pest of apple, pear, cherry, walnut and many other trees and shrubs. Seymour (1978) recorded it in York (VC62) on *Laurus nobilis*, imported from Belgium, x.1976.

Recent collections. **VC61**: Burythorpe, *Malus domestica*, 12.vi.1997; Dunnington, *Crataegus monogyna* and *M. domestica*, 4.xi.1996; Low Catton, *M. domestica*, 20.v.2008; Selby, *Crataegus* sp., 20.vi.2008. **VC62**: Harton, *Crataegus* sp. and *M. domestica*, 17.vi.2008 (abundant, first and second instars); Haxby (widespread), *M. domestica*, 4.x.1996, *Malus sylvestris*, 18.vi.1997 and 23.iv.2008, Westwoods, *C. monogyna* and *M. sylvestris*, 31.v.2008; Hole of Horcum, *Calluna vulgaris* and *M. sylvestris*, 25.iv.2008; Nunnington, *M. domestica*, 15.ix.2006; Sand Hutton, *C. monogyna*, 22.v.2008 (abundant) and *M. domestica*, 22.v.2008; Skelton cemetery, *M. domestica*, 8.vi.2008 (sparse); Strensall Common, *M. sylvestris*, 31.v.2008 (sparse); Thornton Le Dale, *C. monogyna, M. sylvestris* and *Sorbus aucuparia*, 25.iv.2008; Wigginton, *C. monogyna*, 31.v.2008; York, Holgate, West Bank Park, *C. monogyna*, 15.vi.2008, Huntingdon Cemetery, *C. monogyna* and *M. sylvestris*, 22.iv.2008. **VC64**: Brimham Rocks, *Calluna vulgaris*, 3.viii.1997; Leeds, Roundhay Park, *Prunus avium*, 28.vi.2008 (sparse, second instars); Stamford Bridge, *C. monogyna* and *M. sylvestris*, 4.vi.2008 (heavy infestations); Leeds, city centre, *S. aucuparia*, 14.vii.1997; York, Rowntree Park, *C. monogyna*, 16.xi.1996.

Introduced species established on indoor plantings

Twenty-four non-native species (1 Margarodidae, 9 Pseudococcidae, 4 Coccidae, 1 Eriococcidae, 9 Diaspididae) are introduced and established on indoor plantings (although some may not be continuosly present in Yorkshire). Several of the species may also be found outdoors in sheltered conditions. In addition, the CSL recorded *Planococcus* sp. at a plant nursery in West Yorkshire (VC64), on penjing (traded as bonsai) imported from China, 5.ix.1996 (PHSI).

MARGARODIDAE – Giant Scale Insects
Some workers now place *Icerya* in the family Monoplebidae.
* ***Icerya purchasi*** Maskell – Cottony Cushion Scale
This species occurs widely in tropical, subtropical and warm temperate areas. It is broadly polyphagous and is frequently found on *Citrus* and *Laurus* imported from the Mediterranean. It has recently become naturalized in the London area (Watson & Malumphy, 2004), but may be restricted to indoor plantings in Yorkshire.
Recent collection. **VC61**: Beverley, plant nursery, *Laurus nobilis* from Spain, 25.x.2006 and 27.iv.2007 (PHSI).

PSEUDOCOCCIDAE – Mealybugs
* ***Nipaecoccus nipae*** (Maskell) – Coconut Mealybug
This species occurs widely in tropical and subtropical areas and is broadly polyphagous. It is restricted to indoor plantings at a few botanical collections in Britain.
Recent collection. **VC61**: Beverley, plant nursery, *Chamaerops* from the Netherlands, 30.i.2003 (PHSI).

* ***Phenacoccus defectus*** Ferris – Defective Mealybug
This is a polyphagous North American species that has recently been introduced into Britain (Malumphy, 1997). It is morphologically very close to the Nearctic species, *P. solani* Ferris, which has also been found in Britain, and they may prove synonymous.
Recent collection. **VC62**: Haxby, *Crassula portulacea*, 4.xi.1996.

* ***Planococcus citri*** (Risso) – Citrus Mealybug
This is a cosmopolitan polyphagous pest that is very common on indoor plantings throughout Britain.
Recent collection. **VC61**: Beverley, plant nursery, *Geranium* from Israel, 5.ii.1999 and unspecified plant, 11.iv.1997 (PHSI). **VC62**: Haxby, *Chlorophytum comosum*, *Phoenix dactylifera* and *Solanum quitoense*, 27.viii.1997, *Tradescantia* sp., 20.v.1997; Sand Hutton, CSL, *Laelio-Cattleyla* sp., 4.viii.1998. **VC64**: Leeds, botanical glasshouse, *Hibiscus* sp., 5.viii.1997 and several unidentified woody plants, 28.vi.2008.

* ***Pseudococcus longispinus*** (Targioni-Tozzeti) – Long-tailed Mealybug
This is a cosmopolitan polyphagous pest that is very common on indoor plantings throughout Britain.
Recent collections. **VC61**: Beverley, plant nursery, *Cycas* sp. from Italy, 16.v.2003 and *Jasminum sambac*, 12.v.2008 (PHSI). **VC64**: Leeds, botanical glasshouse, *Ficus cyathistipula*, Polypodiaceae and several unidentified plants, 21.vi.1997, 'ferns', *Gardenia grandifolia*, *Hibiscus* sp., Cycadaceae and Polypodiaceae, 5.viii.1997, and several unidentified woody plants, 28.vi.2008; Nether Poppleton, *Dracaena marginata* from the Netherlands, 24.x.1998 (PHSI).

* ***Pseudococcus viburni*** (Signoret) – Glasshouse Mealybug
This is a cosmopolitan polyphagous pest that is very common on indoor plantings throughout Britain. It has also been found breeding outdoors in London.
Recent collections. **VC62**: Nunnington, *Aloe vera*, 28.ii.2008, *Carpobroctus* sp., 22.viii.1998, *Crassula portulacea*, 30.viii.1997 and 26.iv.1998, *Graptopetalum bellum*, 5.xii.1996 (R. Hammon); Pickering, *Aporocactus flagelliformis*, 14.vii.1997 (J. Stonehouse).

* ***Rhizoecus cacticans*** (Hambleton) – Cacticans Mealybug
This is a polyphagous root-feeding species that occurs widely in Britain in public and private botanical collections.
Recent collection. **VC62**: Nunnington, *Pelargonium* sp., 28.ii.2008 (R. Hammon).

Rhizoecus falcifer Künckel d'Herculais – Ground Mealybug
Syn. *Rhizoecus decoratus* Green (1926)
This is a polyphagous root-feeding species that occurs widely in Britain in public and

private botanical collections. Green (1926) recorded it at Eastringham, Hull (VC61) on *Abutilon* (Fox-Wilson).

* ***Spilococcus mammillariae*** (Bouché) – Cactus Mealybug
This is a polyphagous root-feeding species that occurs widely in Britain in public and private botanical collections.
Recent collection. **VC62**: Nunnington, *Opuntia* sp., 5.xii.1996 (R. Hammon); York, cactus, 2007 (D. Collins).

* **Vryburgia amaryllidis** (Bouche) – Lily Bulb Mealybug
This is a polyphagous root-feeding species that occurs widely in Britain in public and private botanical collections.
Recent collection. **VC62**: Nunnington, *Ledebouria violacea*, 16.vi.1997 (R. Hammon).

COCCIDAE – Soft Scales
Coccus hesperidum (Linnaeus) – Brown Soft Scale
Syn. *Lecanium hesperidum* (Linnaeus)
This is a cosmopolitan polyphagous pest that is very common on indoor plantings throughout Britain; it is common outdoors in southern Britain in sheltered urban conditions. Harrison (1915a) recorded it in Middlesborough (VC62) on *Abutilon* in a glasshouse.
Recent collections. **VC61**: Beverley, plant nursery, *Citrus* sp. from Italy, 23.iii.2006 (PHSI), *Laurus nobilis*, unknown origin, 15.xi.1999 (PHSI), from Italy, 5.x.2000 (PHSI) and from Spain, 25.x.2006 (PHSI). **VC62**: Haxby, Bromeliaceae and *Kalachoe manginii*, 4.xi.1996, *Phoenix dactylifera* and *Tradescantia* sp., 27.viii.1997; Helmsley, *Laurus nobilis*, 10.v.2008 (outdoors, abundent on potted plants); Nunnington, *Citrus limon* and *Schaffer* sp., 5.xii.1996 (R. Hammon); Sand Hutton, CSL, *Aeridea fieldingii* and *Laelio-Cattleyla* sp., 4.viii.1998, *Cycas* sp., 4.xii.1996, *Euphorbia pulcherrima*, 12.ii.1997, *Laurus nobilis*, 28.x.1996 (outdoors). **VC64**: Leeds, *Paphiopedilum* sp., 3.viii.1998 (D. Hunt), Botanical glasshouse, *Anthurium* sp., *Ficus* sp., Polypodiaceae, *Schefflera* sp., *Spathiphyllum* sp. and various unidentified woody and herbaceous plants, 21.vi.1997, Ferns, *Ficus benjamina*, *Gardenia grandifolia*, Palmae and Polypodiaceae, 5.viii.1997 and *Strelitzia,* Palmae and various unidentified plants, 28.vi.2008; Wetherby, plant nursery, *Laurus nobilis*, 15.xi.1999 and 5.x.2000 (PHSI); York, *Schefflera* sp., 2.v.2008 (P. Bartlett), Shopping Centre south of York, on *Ficus benjamina* and *Hedera helix*, 23.ii.2008.

* ***Parasaissetia nigra*** (Nietner) – Nigra Scale
This species occurs widely in tropical and subtropical areas and is broadly polyphagous. It occurs in botanical collections in Britain and is listed in the plant health legislation of the European Union (EU).
Recent collection. **VC64**: Leeds, botanical glasshouse, *Passiflora* sp., 28.vi.2008 (abundant).

* ***Saissetia coffeae*** (Walker) – Hemispherical Scale
This species occurs widely in tropical and subtropical areas and is broadly polyphagous. It occurs widely in botanical collections in Britain.
Recent collections. **VC62**: Nunnington, *Chlorophytum* sp., 22.viii.1998 (R. Hammon); Sand Hutton, CSL, indoors, *Laelio-Cattleyla* sp., 4.viii.1998 and *Sarracenia* sp., 29.iv.1998. **VC64**: Leeds, botanical glasshouse, Polypodiaceae and several unidentified ornamental plants, 21.vi.1997, *Coffea arabica*, *Phytonia* sp. and Orchidaceae, 5.viii.1997 and several unidentified woody plants, 28.vi.2008.

* ***Saissetia oleae*** (Olivier) – Black Scale
This species occurs widely in tropical and subtropical areas and is broadly polyphagous. It occurs widely in botanical collections in Britain and has recently been found breeding outdoors in London.
Recent collection. **VC62**: Sand Hutton, CSL indoors, *Olea europea*, 20.i.1999.

ERIOCOCCIDAE – Felt Scales
* ***Ovaticoccus agavium*** (Douglas) – Agave Ovaticoccin
Recent collection. **VC61**: Beverley, plant nursery, *Yucca*, 8.ix.2008 (PHSI).

DIASPIDIDAE – Armoured Scales

* ***Abgrallaspis cyanophylli*** (Signoret) – Cyanophyllum Scale

This is a polphagous cosmopolitan species that occurs widely in Britain in botanical collections. It has also recently been found breeding outdoors in southern England.

Recent collections. **VC61**: Beverley, plant nursery, *Chamaerops* from the Netherlands, 30.i.2003 (PHSI). **VC64**: Leeds, botanical glasshouse, unspecified plant, 5.viii.1997 and *Crassula portulacea*, 28.vi.2008.

* ***Aspidiotus destructor*** Signoret – Coconut or Transparent Scale

This species occurs widely in tropical and subtropical areas and is broadly polyphagous. It is restricted to a few botanical collections in Britain.

Recent collections. **VC61**: Beverley, plant nursery, *Chrysalidocarpus lutescens* from the Netherlands, 5.v.2006. **VC64**: Leeds, botanical glasshouse, Palmae, 26.vi.2008 (abundant) and ?*Rhapis* sp., 21.vi.1997 (abundant; causing chlorotic streaking on the foliage) and 5.viii.1997.

* ***Aspidiotus nerii*** (Bouché) – Oleander Scale

This is a polphagous cosmopolitan species that occurs widely in botanical collections in Britain. It also occasionally breeds outdoors in southern England. It is a major pest of ornamental plants and fruit crops, such as citrus and olive.

Recent collections. **VC61**: Beverley, plant nursery, *Cycas* sp. from Italy, 16.v.2003 (PHSI), *Dracaena* from Italy, 29.vii.2003 (PHSI), *Macrozamia moorei* from Australia, 11.iv.2006 and 4.x.2006 (PHSI), *M. moorei* (abundant), 12.v.2008, and *P. tenax*, 26.ix.2006 (PHSI). **VC62**: Haxby, *Crassula portulacea*, 4.x.1996 and 26.iv.1998; Sand Hutton, CSL, *Olea europea*, various dates 2005-8 (heavy infestation causing chlorosis and distortion of new growth). **VC64**: Leeds, botanical glasshouse, *Cyperus* sp., 21.vi.1997 and 5.viii.1997.

* ***Chrysomphalus aonidum*** (Linnaeus) – Florida Red Scale

This is a polphagous cosmopolitan pest species that is restricted to indoor plantings in cooler regions. It occurs widely in Britain in glasshouse botanical collections.

Recent collections. **VC61**: Beverley, plant nursery, *Chrysalidocarpus lutescens* from the Netherlands, 11.iv.2006 (enormous population causing damage), 5.v.2006 and 4.x.2006 (PHSI).

* ***Diaspis boisduvalii*** Signoret – Boisduval Scale

This is a polphagous cosmopolitan species that occurs widely in botanical collections in Britain.

Recent collections. **VC61**: Beverley, plant nursery, *Butia capitata* from Italy, 28.iv.2004 (PHSI) and *Dasylirion longissimum* from Mexico, 5.v.2006. **VC64**: Leeds, botanical glasshouse, *Strelitzia* sp., 26.vi.2008 (abundant).

* ***Hemiberlesia lataniae*** (Signoret) – Latania Scale

This is a polphagous cosmopolitan species that occurs widely in botanical collections in Britain. The CSL recorded this species in Leeds, leisure centre (VC64) on *Areca* sp., 10.i.1990 (S. Ellis).

Recent collection. **VC64**, Leeds, botanical glasshouse, various unidentified woody plants, 28.vi.2008 (abundant), plant nursery, *Strelitzia sp*., 29.iv.1996 (PHSI).

* ***Lepidosaphes pinnaeformis*** (Bouché) – Cymbidium Scale

Syn. *Lepidosaphes tuberculatus* Malenotti; *L. pinnaeformis* Bouché

This species is widespread in the tropics, subtropics and temperate regions. It is polyphagous, most commonly on Lauraceae and Orchidaceae. Green (1921, 1925) recorded it in Birkenshaw (VC63) on *Cymbidium* sp., iv.1920 (J. C. F. Fryer).

* ***Pinnaspis aspidistrae*** (Signoret) – Fern Scale

This is a polphagous cosmopolitan species that occurs in botanical collections in Britain. Seymour (1978) originally recorded this species as *Pinnaspis* sp. in a nursery in 'Poppleton' (VC62), on *Aspidistra* sp. imported from Belgium, viii.1977.

* ***Pinnaspis buxi*** (Bouché) – Screwpine Scale
This species is widespread in the tropics and subtropics. It is broadly polyphagous and is common on Palmae. It is rarely recorded in botanical collections in Britain.
Recent collections. **VC61**: Beverley, plant nursery, *Chrysalidocarpus lutescens* from the Netherlands, 5.v.2006 (PHSI). **VC64**: Leeds, botanical glasshouse, Palmae, 21.vi.1997 and 5.viii.1997.

NON-ESTABLISHED INTRODUCTIONS
Eleven non-native species (1 Pseudococcidae, 1 Coccidae, 9 Diaspididae) have been recorded in the region on imported growing plants, but are not known to have established anywhere in Britain. In most cases action was taken to eradicate the pests with advice provided by the PHSI and the CSL. Coccoidea found on plant produce such as fruit or cut flowers are not included.

PSEUDOCOCCIDAE – Mealybugs
* ***Ripersiella hibisci*** (Kawai & Takagi) – a Root Mealybug
Syn. *Rhizoecus hibisci* (Kawai & Takagi)
This is an Asian species that has spread to the USA (including Hawaii) and Puerto Rico. It is broadly polyphagous and a pest of a wide range of ornamental plants. It has been repeatedly intercepted in England since 1993 on the roots of penjing (traded as 'bonsai') *Serrisa, Ulmus* and *Zelkova* imported from China (Malumphy & Robinson, 2004). It is listed in the plant health legislation of the EU.
Recent collection. **VC61**: Beverley, plant nursery, penjing from China, 13.x.1997 (PHSI).

COCCIDAE – Soft Scales
Pulvinaria psidii (Maskell) – Green Shield Scale
Syn. *Chloropulvinaria psidii* (Maskell)
This species occurs widely in the tropics and subtropics and is broadly polyphagous. Green (1928) recorded it in York (VC62), Rowntree's Tropical House, on an unidentified shrub (H. Britton).

DIASPIDIDAE – Armoured Scales
* ***Acutaspis*** sp.
Recent collection. **VC61**: Beverley, plant nursery, *Chamaerops* sp. from the Netherlands, 30.i.2003 (PHSI).

* ***Aonidiella taxus*** Leonardi – Asiatic Red Scale
This is an Asian species that has been introduced to parts of North and South America and the Mediterranean. It feeds on evergreen species belonging to the Cephalotaxaceae, Podocarpaceae and Taxaceae.
Recent collection. **VC64**: Leeds, plant nursery, *Podocarpus* sp. from China, 15.iv.1996 (PHSI).

* ***Aonidiella tinerfensis*** (Lindinger) – Dragon Plant Scale
This species is native to the Canary Islands and has been introduced to Portugal. It is host specific to *Dracaena drago*.
Recent collections. **VC61**: Beverley, plant nursery, *D. draco*, from Spain (Canary Islands), 11.iv.2006 (enormous population causing severe damage; the plant was destroyed) (PHSI) and 5.v.2006.

* ***Aulacaspis yasumatsui*** Tagaki – Aulacaspis Cycad Scale
This species is probably native to Thailand, but since the early 1990s has spread rapidly in plant trade and is now recorded widely in Asia, Ivory Coast, USA (including Hawaii), Caribbean, Pacific Islands and the Netherlands (Malumphy & Matthews, 2006). It feeds on cycads belonging to the Cycadaceae, Stangeriaceae and Zamiaceae. *Cycas revoluta* is a preferred host.
Recent collections. **VC61**: Beverley, plant nursery, *Cycas revoluta* from Vietnam, 11.iv.2006 and 4.x.2006 (large population developing on new shoots) (PHSI). In addition, suspected *A. yasumatsui* was found on *Cycas* sp. from Vietnam, at a plant nursery in Beverley, 26.i.2005.

Chrysomphalus dictyospermi (Morgan) – Dictyospermi Scale
Syn. *Aspidiotus dictyopspermi* var. *arecae* (Newstead)
This species occurs widely in the tropics, subtropics and warm temperate regions. It is broadly polyphagous and commonly recorded on *Citrus, Dracaena, Ficus* and palms. It is a serious pest of *Citrus*. Harrison (1915) recorded it on Palmae in glasshouses in Middlesborough (VC62).

* ***Ischnaspis longirostris*** (Signoret) – Black Thread Scale
This is a pantropical and subtropical species and is broadly polyphagous. It is a pest of palms, *Ficus* and *Citrus*.
Recent collections. **VC61**: Beverley, plant nursery, *Chamaerops* from the Netherlands, 30.i.2003 (PHSI), *Chrysalidocarpus lutescens* from the Netherlands, 5.v.2006.

* ***Lindingaspis rossi*** (Rossi) – Araucaria Black Scale
This species occurs widely in the tropics and subtropics, and also in the Mediterranean basin. It is broadly polyphagous. Although it is recorded here as a non-established introduction, it may have been present at one location for two years.
Recent collections. **VC61**: Beverley, plant nursery, *Yucca filifera* from the USA, 23.v.2006 (enormous population causing severe damage) (PHSI), *M. moorei*, 12.v.2008 (abundant) (PHSI).

* ***Pinnaspis strachani*** (Cooley) – Lesser Snow Scale
Syn. *Pinnaspis marchali* (Cockerell)
This species occurs widely in the tropics, subtropics and warm temperate regions. It is polyphagous feeding on plants belonging to at least 27 families. The status of this species in Britain is uncertain, as it is frequently misidentified as *P. aspidistrae*. Green (1928) recorded it in York (VC62), Rowntree's tropical House, on *Hibiscus roseus* (Britten).

* ***Unaspis citri*** (Comstock) – Citrus Snow Scale
This is a pantropical and subtropical, broadly polyphagous species that is a major pest of citrus. It is listed in the plant health legislation of the EU. Seymour (1978) recorded this species in 'Poppleton' (VC62), on *Citrus* sp., xi.1977 (PHSI).

Discussion

Seventy-four species of scale insect belonging to nine families have been recorded in Watsonian Yorkshire, of which 43 species (60%) are recorded here for Yorkshire for the first time. Thirty-five native species (approx. one third of the native British species) are recorded from Yorkshire. The majority of the native species belong to the families Coccidae and Eriococcidae and the most common and widespread species are: *Asterodiaspis quercicola, A. variolosa*, *Chionaspis salicis*, *Cryptococcus fagisuga*, *Eulecanium tiliae*, *Lepidosaphes ulmi*, *Phenacoccus aceris* and *Pseudochermes fraxini*. These species are likely to occur throughout the region, wherever suitable host plants are found. Fourteen native species are recorded on plants in the Gramineae and Cyperaceae, eight on Fagaceae, seven on Rosaceae, and four on Ericaceae. Seven species have been recorded on *Quercus robur,* five on *Crataegus monogyna* and four on *Sorbus aucuparia*. The highest number of native species collected at a single locality is 19 at Strensall Common, an area of wet, low moorland and mixed woodland. In addition, the introduced, naturalised species, *Pulvinaria regalis*, has recently been found at Strensall Common.

Half of the scale insect species reported in Yorkshire are of exotic origin and the majority of these belong to the families Diaspididiae and Pseudococidae. All of the non-native species that occur in the region are restricted to indoor plantings, with the exception of *Balanococcus diminutus*, *Carulaspis minima*, *P. floccifera, P. regalis* and *Coccus hesperidum*. *Pulvinaria floccifera* and *P. regalis* have increased dramatically in abundance and distribution between 1996 and 2008. *Carulaspis minima* is a Mediterranean species that has recently been detected in Yorkshire, its most northerly record in Britain.

The majority of the samples were collected by the author in VC62, primarily from the Vale of York, and many areas of Watsonian Yorkshire have not been investigated; for example, the North Yorkshire Moors, Yorkshire Dales and coastal areas have not been adequately searched and there are undoubtedly further native species of Coccoidea awaiting detection.

Acknowledgements

I would like to express my sincere gratitude to the following people who have collected specimens mentioned in this work: H. Anderson, P. Bartlett, D. Collins, J. Ostojá-Starzewski, D. Pye and J. Stonehouse of the CSL; G. Bloemers, R. Hammon, L. MacLeod and Dr R. Smith, formerly of the CSL; C. Barrass, S. Ellis, D. Howard, M. Lazenby, D. Miller, A. Riley, A. Walters and G. Watt of the PHSI, and D. Hunt of Leeds. I would also like to thank J. Small of the Yorkshire Wildlife Trust for permission to collect on their reserves; J. Clark, formerly of the CSL, for the identification of Gramineae, Dr J. Noyes of the NHM for the identification of hymenopterous parasitoids, and Dr K. Harris for the identification of the Cecidomyiidae.

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CORRECTION

In the Botanical Report for 2008 (*Naturalist* **133**: 135-139, 2009), three species of *Hieracium* were reported as new to VC 64. However, these species, *H. amnicola* P.D.Sell (formerly *H. rubiginosum* var. *rivulare* Pugsley), *H. boreoanglicum* P.D.Sell (formerly *H. pseudostenstroemii* Pugsley) and *H. subcyaneum* (W.R.Linton) Pugsley (formerly *H. silvaticum* var. *subcyaneum* W.R.Linton), had been renamed by P.D. Sell in P.[D.] Sell and G. Murrell *Flora of Great Britain and Ireland* (2006) and were therefore not new to the vice-county. I am grateful to Vince Jones for pointing out the error.

P.P.Abbott

BRAMBLES REVISITED IN NORTH-EAST YORKSHIRE

ALAN NEWTON
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The first published account of the brambles of North-east Yorkshire was by Rogers (1891) who visited the Yorkshire Dales, staying at Helmsley in late August and early September of that year. My own first visit to the area for exploration of the bramble flora in 1973 included the Helmsley district, the moors and dales of Cleveland, and the extensive woodland of Danby Forest west of Scarborough. The results of this visit were incorporated in Edees and Newton (1988) which included distribution maps and data on all the named microspecies. Additions were made over the next 30 years from herbarium material and submissions from local botanists which were published in Newton and Randall (2004).

In 2008, I resolved to repeat my 1973 survey, spending a week there in the second half of July when we were favoured with good weather. The brambles were in good condition at this period (a month earlier than in 1891), all species still in good flower with new primocanes and incipient fruit. The species list with commentary based on my 2008 observations appears below, together with a census list (Table 1) in order of frequency, with hectad and 1 km localities where helpful.

Section *RUBUS*
Suberect *Rubi*
While both *Rubus scissus* and *R. plicatus* were noted in a few places in 1973, no suberect brambles could be found in 2008. The terrain appears now less favourable with the reduction of peripheral moorland and the expansion of forested areas both horizontally and vertically. Riccaldale, for instance, now has a higher denser canopy, not surprisingly representing the growth of 35 years.

Series *Silvatici*
R. lindleianus Lees
Occasional in hedgerows in the Cleveland valleys, but shunning the more exposed spots as elsewhere.
R. pyramidalis Kaltenb.
Rare, only occurring as single bushes on the better soils of Suffield Moor and Danby Forest. Widespread in northwest Europe.
R. robiae (W.C.R.Wats.) A.Newton
Apparently disappeared from its *locus classicus* on Yearsley Moor, but not seen elsewhere.

Series *Rhamnifolii*
R. amplificatus Lees
Rare, but good bushes can be found usually in old woods and hedges along the western edge of the Cleveland Hills escarpment. There are old collections of J.G.Baker (1834-1920) from Boultby. It clearly is at home (as in Ireland) on the less acid soils.
R. incurvatiformis Edees
Rare in the district, but a few good sites in western Cleveland.
R. lindebergii P.J.Müll.
Splendid bushes with cascades of milk-white flowers, still to be found around the Egton Moors, but less conspicuous due to reclamation of heathland patches.
R. nemoralis P.J.Müll.
Occasional throughout the area. A well marked plant with pink cupped flowers, short stamens and strong curved prickles on the panicle rachis.
R. pistoris Barton & Riddelsd.
A distinctive small leaved plant resembling a dwarf *R. nemoralis* was seen once by a lane-side near Harwood Dale. Frequent at Gormire, the *locus classicus*.

R. polyanthemus Lindeb.
Common throughout the district as in the British Isles as a whole.

Series *Discolores*
R. armeniacus Focke (Himalayan Giant)
Bird sown in two places only.
R. armipotens Barton ex A.Newton
Still at the same site on the edge of Cropton Forest near Blackpark Lodge (SE 7590). This is the only English site known north of the Midlands.
R. ulmifolius Schott
Common in hedges in the lower parts of the area; confined to the coast going northwards.

Series *Vestiti*
R. vestitus Weihe
Occasional, but never in any quantity. Both red and white flowered forms observed.

Series *Mucronati*
R. mucronulatus Bor.
Rare, probably over-shaded in a few 1973 forest sites: certainly less conspicuous.
R. wirralensis A.Newton
One sighting only on the western fringe of the area.

Series *Micantes*
R. newbouldii Bab.
Only seen at Yearsley Moor, but there in great quantity and luxuriance.

Series *Anisacanthi*
R. anisacanthos G.Brown
Four sightings of this predominantly north-easterly bramble on heath and moor fringes. Widespread also in northern Germany.
R. cinerosus Rogers
Discovered by Rogers (1891) in the Helmsley district "in considerable quantity, a very strong form of *R. polyanthemus* at Riccaldale, Nunnington & Rievaulx"; I found this easily at Riccaldale in 1973, but searched vainly for it at the other two sites. Only a small amount was visible in 2008 in Riccaldale in heavy shade. Two new sites, however, were found near Great Ayton and above the Raisdale Beck by the roadside. West Cleveland might well produce further stations for this rare bramble if searched for diligently.
R. drejeri G.Jensen
Seen in four eastern localities. I collected this plant in Danby Forest in 1973, but was not then aware of its identity; see Newton (1979) for historical details.
R. infestus Weihe ex Boenn.
Rare and in small quantity. Local also in1891.
R. echinatoides (Rogers) Dallman
Very common throughout north-east Yorkshire. First recognised by Rogers (1891) as a "strongly armed form approaching *R. echinatus*" and described as a variety of *R. radula* in 1894. A beautiful dwarf form was found at Grosmont in 2008.
R. pallidus Weihe
Remarkably frequent over the whole district; handsome bushes in woods, thickets and hedge banks. The white petals with red styles and neat foliage are distinctive.
R. radula Weihe ex Boenn.
Occasional in hedge banks. Predominantly a plant of eastern Britain, increasingly frequent in eastern Scotland.

TABLE 1. Bramble localities in North-east Yorkshire visited in 2008.

WM Rogers visit in 1891	Currently accepted name	NZ 50	NZ 51	NZ 60	NZ 70	NZ 71	NZ 80	NZ 81	NZ 90	SE 57	SE 68	SE 69	SE 79	SE 88	SE 89	SE 98	SE 99	TA 09
koehleri var. *pallidus*	*dasyphyllus*	X	X	X	X	X	X	X		X	X	X		X	X	X	X	
radula var.	*echinatoides*	X	X	X	X	X	X (incl. dwarf)					X	X	X	X		X	X
polyanthemus	*polyanthemus*			X	X		X	X	X	X							X	
villicaulis	*nemoralis*			X	X					X		X	X	X		X		
sublustris	*pruinosus*		X			X		X					X				X	X
fasciculatus	*warrenii*	X	X					X	X	X	X							
leucostachys	*vestitus*		X			X	X				X							
Not observed	*anisacanthos*				X		X							X			X	
Not observed	*drejeri*											X		X	X		X	
pallidus	*pallidus*	X				X					X	X						
corylifolius agg.	*conjungens*	X	X					X									X	
lindleianus	*lindleianus*				X		X										X	
lindebergii	*lindebergii*				X								X	X				
radula	*radula*			X			X							X				
polyanthemus (prickly var).	*cinerosus*	X	X								X							
Not observed	*pedemontanus*				X									X	X			
corylifolius agg.	*eboracensis*						X				X		X					
Not observed	*amplificatus*	X										X						
Not observed	*pyramidalis*														X		X	
infestus	*infestus*									X							X	
rusticanus	*ulmifolius*	X				X												
Not observed	*mucronulatus*					X								X				
Not observed	*armeniacus*										X		X					
corylifolius agg.	*hindii*		X				X											
Not observed	*pistoris*																X	
Not observed	*armipotens*												X					
Not observed	*incurvatiformis*			X														
Not observed	*wirralensis*	X																
Not observed	*newbouldii*									X								
corylifolius agg.	*halsteadensis*								X									
caesius	*caesius*													X				
		NZ 5400 5908 5706 5205	NZ 5811	NZ 6605 6809	NZ 7506 7607 7804 7908	NZ 7313 7718 7516	NZ 8205 8207 8408	NZ 8512	NZ 9801	SE 5775	SE 6384	SE 6998	SE 7590	SE 8588 8689	SE 8790 8890	SE 9488	SE 9595 9793 9899	TA 0094

Series *Hystrices*
R.dasyphyllus (Rogers) Marshall
The most common and widespread bramble in north-east Yorkshire, as in northern England as a whole. Abundant on moorland fringes and upland roadsides under stone walls, but also in woods.

Series *Glandulosi*
R. pedemontamus Pinkw.
In Danby Forest occurs as huge thickets, flowering well and impervious to shade. Untypically it also occurs in the open heathland of Egton Moors, but is less conspicuous than noted in my 1973 visit.

Section *CORYLIFOLII*
Rogers regarded this group as common and variable when he made his visit in 1891. Two of the most recognisable then are now known as *R. pruinosus* and *R. warrenii*, both frequent in the district as a whole. Today, *R. conjungens* is found particularly near the coast and there are single records for recently named *R. hindii* and *R. halsteadensis*, the latter not far from its stronghold in Holderness. It was found close to old railway land and could well occur more widely near such terrain. *R. eboracensis* is much less frequent than further south in Yorkshire.

Section *CAESII*
R. caesius L.
Only found in quantity on the calcareous ground in the Scarborough district, but may well occur in other coastal localities.

Acknowledgements
Financial assistance from the Botanical Research Fund is gratefully acknowledged.

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BOOK REVIEW

An Introduction to Mathematical Models in Ecology and Evolution. Time and Space by **Michael Gillman.** Pp. vi + 158. Second edition. Wiley-Blackwell. 2009. £29.95 paperback.

This is an academic textbook giving a good introduction to mathematical models mainly in ecology but also evolution, intended for advanced undergraduates and postgraduates. The models are well explained and usually easy to follow. In order, the book deals with simple and multiple regression with residuals, population changes during time, stochastic models, structured populations, density dependence, interactions between two and multiple populations and population spatial models. There is a good list of references and the text is well illustrated with figures and tables. It can be recommended to those starting to study in this field of mathematical models.

A GEORGIAN HERBARIUM REDISCOVERED

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In 2003, Dr James Compton of the University of Reading went for lunch to a public house at Farnham in rural Dorset, and was astonished to observe a collection of framed and mounted herbarium specimens decorating its dining room walls. Having ascertained from the pub's management that this was merely part of a larger collection, he was encouraged to borrow the remaining specimens in order to research the identity of the original owner. David Allen was asked for help, and he advised him to consult Peter Davis of the University of Newcastle upon Tyne. E-mails were exchanged, and a meeting with James Compton and the author was convened at the pub (where else?), whereupon the owners generously agreed that those specimens not on display could be taken to Liverpool Museum for further study and analysis.

The herbarium (hereafter referred to as the Museum Inn Herbarium) consists of 123 specimens of flowering plants, no ferns and one *Chara*. They are predominantly herbaceous specimens, and the majority are of relatively uncommon species, the rarest being *Scheuchzeria palustris*. The largest group represented are the Caryophyllaceae. Unfortunately many are unlocalised, but a few bear the names of collectors; some have printed labels indicating that they were distributed as *exsiccatae* by James Dickson of Covent Garden, who collected the specimens in Scotland.

Who were the collectors?

The different scripts on the labels were analysed and matched with those of known collectors, notably Sir James Edward Smith. Some labels bore abbreviated names (e.g. J.D. for Rev. James Dalton, and N.J.W. for Nathaniel J. Winch); others were labelled with the name of the collector: Mr Bingley, Rev. Richard Relhan, Rev. Mr Rudston, Rev. John Harriman and Mr Knapp. There remained, however, a large number of specimens with no collector's name attached. Their localities ranged from Cornwall and Essex through Yorkshire and County Durham to the Scottish Highlands.

A comparison of the handwriting on these anonymous gatherings with that of letters in the Winch correspondence at the Linnean Society of London (in particular, the letter in vol. 1, folio 170) enabled the author of the label captions to be identified as the Rev. James Dalton (1764-1843). They also offered a partial explanation of the presence of specimens labelled "N.J.W.". A letter from Dalton to Nathaniel Winch dated August 1804 offered to exchange *desiderata* (Linnean Society, Winch Corr., W1.161). These were sent to Winch on 27 September of that year (*ibid*., W1.167) and letters acknowledging receipt of Winch's specimens were dated 27 September and 16 November 1804.

These clues to the possible identity of the former owner prompted me to visit the Yorkshire Museum (YRK), where James Dalton's main herbarium is now kept. In 1827 this was donated to the Yorkshire Philosophical Society according to Wilkinson (1895). In 1828, Rev. William Hincks was appointed Hon. Curator of Botany, and he started to merge the Dalton collection with that of William Middleton (d. 1842) and later with material from Samuel Hailstone (1767-1851) and Giles Munby (1816-1876). The herbarium was later incorporated into the YRK collections. According to Wilkinson (1895), the Dalton collection here represents a large portion of the botanical work done by Dalton during the years 1780 to 1820.

Identifying the origin of the handwriting did not necessarily identify the collector, however. Many of the specimens were from North Yorkshire; only a few were from Teesdale and these were more likely to have been collected by Dalton or Robson.

As a result of the initial contacts with Professor Peter Davis, the name of William Brunton (of Ripon) as principal collector was proposed by Dr Frank Horsman, who has undertaken much research on the early botanists of Teesdale. The likelihood that the main

collector was a Yorkshireman was borne out by the geographical area from which most were collected, as well as the fact that Brunton's name does not appear on any of the specimens as a donor. According to Wilkinson (1895), the William Brunton herbarium was incorporated into Hailstone's collection prior to its acquisition by the Yorkshire Philosophical Society, which could explain why Brunton's specimens at YRK were not labelled in his own handwriting.

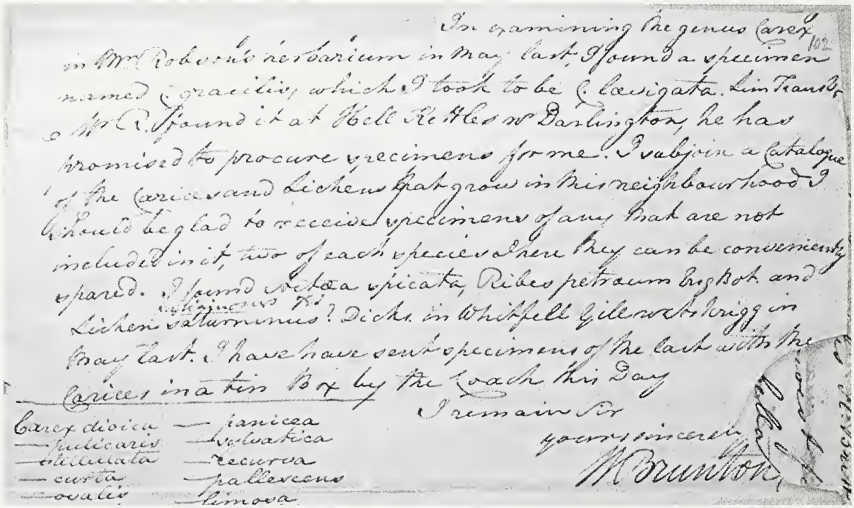


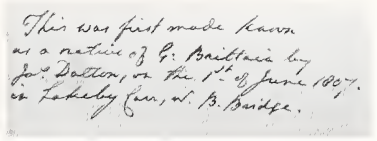
FIGURE 1. Sample of William Brunton's handwriting and signature (© and by permission of the Linnean Society of London: Winch Correspondence, vol. 1, folio 102)

Dr F. Horsman (*pers. comm.*) has found labels from the following localities on specimens given by Brunton to Edward Robson (whose herbarium is now kept at Sunderland Museum): "Mackershaw Wood Nr. Ripon"; "Hazleton Gill above Arncliffe, Craven"; Studley Woods nr. Ripon", and "Hutton Moor nr. Ripon". These match three of the Yorkshire localities mentioned on labels in the Museum Inn Herbarium:

Craven, bog in
Fountains Abbey, walls of
Hackfall woods
Hazleton Gill above Arncliffe in Craven
Hutton Moor; River Ure near Hutton
Knaresborough rocks
Mackershaw valley, Mackershaw wood
Pateley Bridge and Greenough Hill, on the moor between
Pocklington, roadside near Sawley moor
Studley woods,
lime kilns.

It therefore seems highly likely that Brunton collected these specimens which later passed to a subsequent owner of the Museum Inn Herbarium. There is a problem in identifying Brunton as the compiler of the collection as a whole: a specimen of *Scheuchzeria palustris* bears the following annotation:

This was first made known as a native of G. Brittain [sic] by Ja^{s}. Dalton, on the 1st of June 1807, in Lakeby Carr, nr. B. Bridge.

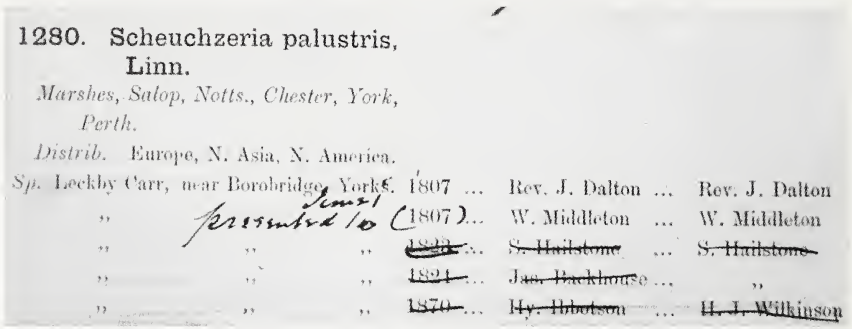


William Brunton died on 23 June 1806, so could not have been the author of this label. Rev. James Dalton, who is known to have exchanged a few specimens with Sir James Edward Smith, was one of Brunton's contemporaries. A search of the Smithian herbarium database (Edmondson & Smith, 1999) revealed the names of four Dalton specimens now kept at LINN-Smith, all of which were obtained by Smith in 1807: *Carex oederi* b, *Lysimachia thyrsiflora*, *Juncus articulatus* and *Scheuchzeria palustris*. The latter species was first discovered in Britain by Dalton in 1787 (Desmond, 1994) in the year that he graduated from Clare Hall, University of Cambridge and was ordained as a deacon. At least three specimens of *Scheuchzeria palustris* were collected by Dalton from this locality. In addition to the sheet sent to Sir James E. Smith, there is a specimen in the Museum Inn Herbarium and another in YRK (Fig. 2).

This was first made known
as a native of G: Brittain by
Jas. Dalton, on the 1st of June 1807.
in Lakeby Carr, nr. B. Bridge.
Scheuchzeria palustris.

FIGURE 2. Museum Inn sheet of *Scheuchzeria palustris*

The specimen at YRK, ex herb. J. Dalton, is annotated as follows:



1280. Scheuchzeria palustris, Linn.

Marshes, Salop, Notts., Chester, York, Perth.

Distrib. Europe, N. Asia, N. America.

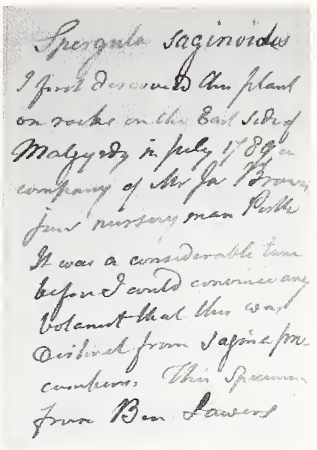
Sp. Leckby Carr, near Borobridge, York.			1807 ...	Rev. J. Dalton ...	Rev. J. Dalton
,,	Presented to	James	(1807)...	W. Middleton ...	W. Middleton
,,	,,	,,	~~1823~~...	~~S. Hailstone~~ ...	~~S. Hailstone~~
,,	,,	,,	~~1824~~...	~~Jas. Backhouse~~ ...	,,
,,	,,	,,	~~1870~~...	~~Hy. Hibotson~~ ...	~~H. J. Wilkinson~~

Leckby Carr, near Borobridge, Yorks. 1807. Rev. J. Dalton [collector]. Rev. J. Dalton [donor].

This label was cut from Wilkinson's catalogue of the herbarium (Wilkinson, 1895-1917), annotated and adhered to the herbarium sheet. The former label does not prove conclusively that the Museum Inn gathering is from the same place and date, as it can be read as being purely informative rather than referring to the source of the actual specimen. It is debatable whether the owner of the herbarium would refer to himself in the third person. However, on balance, taking into account the remarkable resemblance shown between the YRK and Museum Inn Herbarium specimens, it would appear that the latter collection does indeed represent part of Dalton's original discovery.

There is a striking similarity between the specimen of *Silene nutans* from "Rocks at Knaresborough", *Wm. Brunton* (collected in the year 1800) at YRK and that of *Silene nutans* from the Museum Inn Herbarium labelled "Knaresboro rocks" (Fig. 3). Again, the specimens in YRK have been re-labelled, presumably by Hincks, making it impossible to match the original handwriting from the Museum Inn Herbarium with specimens from YRK.

FIGURE 3. Comparison of specimens of *Silene nutans* from the Museum Inn (on screen) and from YRK (left)


Spergula saginoides
I first discovered this plant on rocks on the East Side of Malgyrdy in July 1789 in company of Mr Ja. Brown jun. nursery man Perth. It was a considerable time before I could convince any botanist that this was distinct from Sagina procumbens. This specimen from Ben Lawers

Another annotation, in a different hand, is found on a specimen of *Sagina saginoides* (labelled *Spergula saginoides*):

A specimen in YRK contains a rather similar, if lengthier, caption (A note has been added in pencil giving the name of the collector as George Don [the elder]):

Spergula saginoides

I first discovered this plant in company with Mr James Brown Nursery[man] Perth on rocks on the east side of Mal gherdy a mountain above Kiline in Bredalbane in July 1790 and afterwards on Ben Lawers in 1794. It was several years before the late Mr Mackay or any other man believe it distinct from either the Spergula subulata or the Sagina procumbens but no soon[er] have I assured Mackay that it was different than he claimed this descovery as you will se[e] by Fl. Brit. in the year 1790 that man knows not [illeg.] plants in the world so determined was he to have fame that he unhinged every thing of principle in order to obtain it. I may further add it was to me alone he owed all his Botanicle knowledge that he ever possessed and that was the way he repaid me.

This label suggests that the Museum Inn specimen (from Ben Lawers) was collected in 1794, although the uncharitable comments on 'the late Mr Mackay' (i.e. John Mackay, 1772-1802) were omitted from that label. There are several Scottish specimens with the same handwriting in the Museum Inn Herbarium, for which George Don was evidently the collector. Collections by Don have not previously been reported from YRK. There is another specimen of this species from Ben Lawers collected by the Mackay brothers in the J.E. Smith herbarium at LINN.

"Rev. Mr. Rudston", who is not mentioned in Desmond (1994), is named as the collector of one specimen in the Museum Inn Herbarium. He is believed to have resided at Sand Hutton near York (F. Horsman, *pers. comm.*), but to have been a Quaker by religion and thus not deserving the title 'Reverend'. A gentleman by the name of Thomas Cutter Rudston-Read resided at Sand Hutton around 1812; his son Thomas Frederick was ordained in 1835, but his own occupation is unknown. He supplied a specimen of *Cypripedium calceolus* "Wild from the County of Durham" to Sir James Smith in 1797.

There is also a specimen from Cambridgeshire collected by 'Relhan' (Rev. Richard Relhan of Trinity College, Cambridge, later a minister in Lincolnshire). Relhan also exchanged specimens with Sir James Smith, and the Museum Inn herbarium contains several specimens which either came from localities associated with Smith or with labels in his hand:

Ben Lawers (possibly collected by Winch or Mackay)
Bomere Pool, Shrewsbury (probably collected by Rev. Edward Williams)
Cornwall; near Penzance (labels in Smith's hand, possibly collected by F. Borone)
Essex (label in Smith's hand)
near Holme; Thetford Heath; Yarmouth (Norfolk)

The Quaker botanist Edward Robson was originally considered as a possible author of the Museum Inn Herbarium's labels, though comparison of these with samples of his handwriting in the Linnean Society's Winch Correspondence archive ruled him out. He is, however, represented as a collector of specimens from 'City of Durham' and 'in Teesdale'. Specimens from Robson are to be found in the Harriman Herbarium at LIV as well as that of J.E. Smith at LINN.

In addition to British native specimens collected by Robson in the Museum Inn Herbarium, an unlocalised specimen labelled *Panicum sanguinale* (= *Digitaria sanguinalis*) bears a striking resemblance to one at YRK with a handwritten label 'Sunderland Ballast Hills, Robson, 1780' and a printed label with the same locality and the name of Rev. J. Dalton (the donor). This tends to indicate that the collector, in this case Robson, donated one specimen to Dalton and the other to the original owner of the Museum Inn Herbarium, though it is possible that Dalton was the recipient of both specimens and later disposed of a duplicate. This latter possibility would explain why the Museum Inn specimen bore no collector's name or locality.

Conclusion: Who was the owner?

Although the identity of the compiler of the Museum Inn Herbarium cannot be proved conclusively, the evidence indicates that the collection started to be assembled in the early 1790s; that Rev. James Dalton brought the various collections together and labelled some of them; and that Rev. William Bingley, William Brunton, George Don, Rev. John Harriman, John L. Knapp, James Mackay, Rev. Richard Relhan, Edward Robson, the "Rev." Rudston, Sir James Edward Smith, Rev. Edward Williams and Nathaniel J. Winch all contributed specimens. The person who was the source of the largest amount of material was William Brunton, whose premature death in 1806 may have led to his herbarium, containing duplicates of the specimens exchanged with other botanists, finding a new owner. What little dateable evidence exists indicates that shortly after the death of William Brunton the collection ceased to be added to. How it became separated from Dalton's other herbarium material is unknown. Prior to its reappearance at the Museum Inn in Dorset, we know only that the collection surfaced at a country auction, possibly in Somerset, in the late 1990s (James Compton, *pers. comm.*). The history of the Museum Inn Herbarium during the 19th and 20th centuries is probably destined to remain a mystery.

Acknowledgements

I am grateful to the owners of the Museum Inn, Farnham, Dorset for the generous loan of specimens from their herbarium; to David E. Allen, James Compton, Peter Davis, Frank Horsman and Leander Wolstenholme for their advice and assistance; to Gina Douglas, Librarian and Archivist at the Linnean Society of London, for enabling me to consult the J.E. Smith and N. Winch archives; to the Librarian of Trinity College, Cambridge for providing access to the Dawson Turner correspondence; and to colleagues at the Yorkshire Museum, Stuart Ogilvy and Camilla Nichol, for providing facilities to study the Yorkshire Philosophical Society's herbarium.

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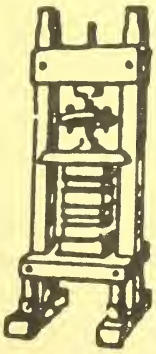

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